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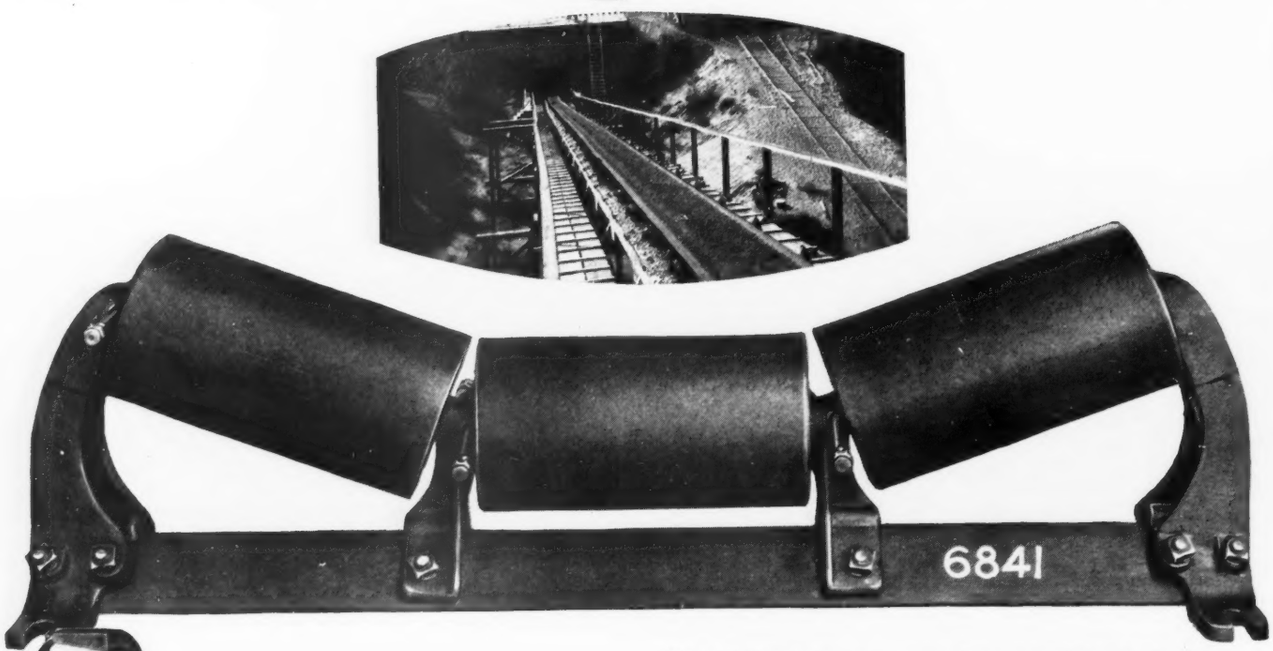
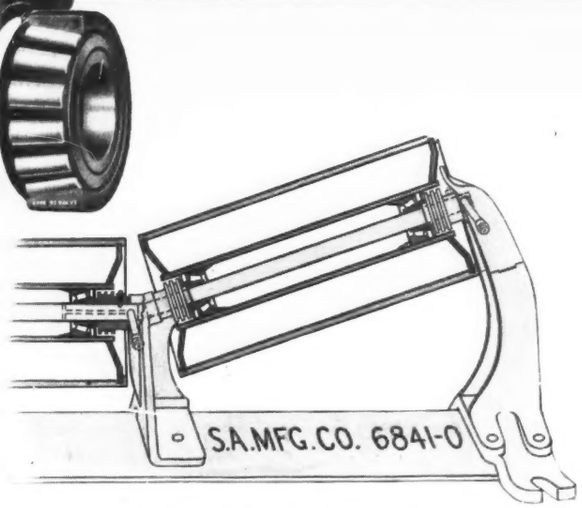
Is Mining to Thrive Again in Panama? by G. C. Riddell

Flotation in the Treatment of Gold and Silver Ores, by M. W. von Bernewitz

Difficulties of Pumping at Veta Grande, by Fred W. Ruttencutter

Simplicity of design and Timken Bearings feature the S-A "Simplex" Carrier





Cross section shows pulley construction and bearing mounting of S-A Simplex Conveyor Carrier. The Simplex is designed for belt conveyors from 18 to 60 inches wide.

The "Simplex" is another notable S-A design in belt conveyor carriers. With a minimum number of parts, all-steel pulleys with seamless drawn steel ends, each pulley is well-balanced and practically unbreakable. There are no sharp edges to fray belt and carrier tilts slightly to help train the belt.

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Volume 124 New York, October 15, 1927 Number 16

ENGINEERING AND MINING JOURNAL

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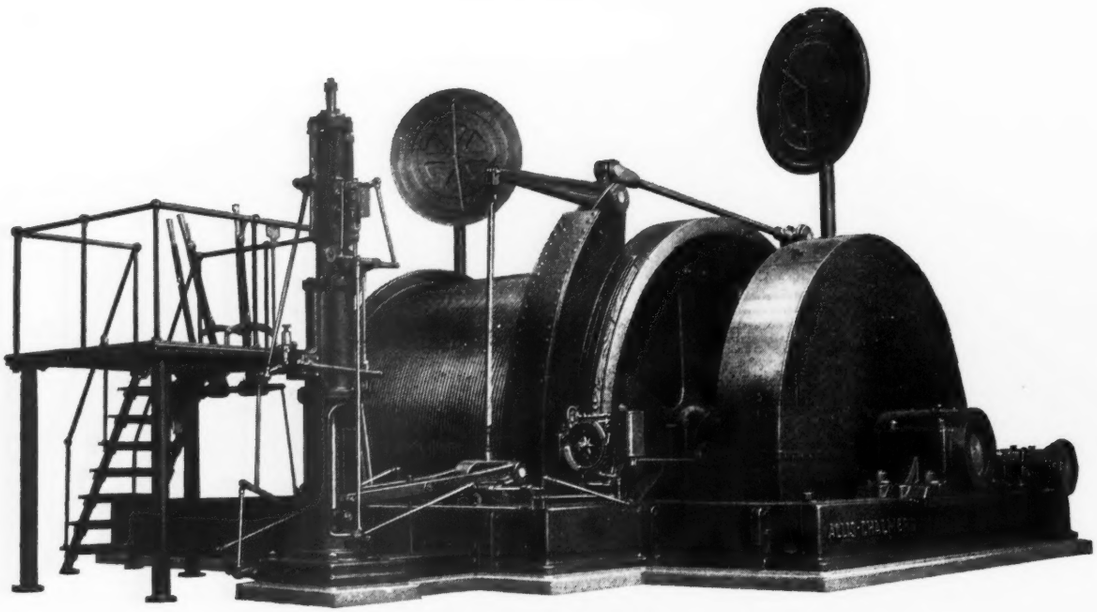

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ENGINEERING AND
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McGraw-Hill Publishing Company, Inc.
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Editor

VOLUME 124 — New York, October 15, 1927 — NUMBER 16

The Field for Inventive Ingenuity

POWER plays so important a part in every mining and metallurgical operation that interest will be revived by the announcement that the Benson system of high-temperature and high-pressure steam generation is finding practical application in Germany. However satisfied engineers may be with existing methods, it behooves American industry to keep an eye on this trend of practice, even though the development points toward what may appear to involve the attainment of new and apparently fantastical standards of boiler operation.

The successful production and harnessing, without appreciable hazard, of higher and still higher pressures marks what is unquestionably an advance in engineering practice. This progress, like all progress of such a nature, has been hampered by conservation and skepticism. James Watt commenced his historic experiments with a pressure of seven pounds per square inch. A hundred years or more passed before a bolder grasp of fundamentals indicated the practicability of working pressures of from 300 to 400 lb. Now we are to become familiar with a developed pressure of over 3,000 lb., and an applied pressure that is little less.

This advance is not a freak development, but is based on a scientific appreciation of thermal effects. It employs with an adequate factor of safety those means that mechanical and metallurgical science has developed for the production and control of high pressures, applied with such success in recent years in the chemical industry, in the synthesis of gaseous elements, for example.

In place of the customary boiler tubes, the Benson principle utilizes extremely narrow-bore coils, in which an almost instantaneous conversion of water into steam takes place, the latter being produced at the critical temperature of water—about 700 deg. Fahrenheit. The speed of driven machinery will be in logical ratio to the immense pressures developed; and the use of scientific lubrication methods, also a comparatively recent refinement, will play an important part in the application of the basic idea.

The foundation of progress is thought, rather than the utilization of acquired knowledge. Many engineers will reserve judgment as to the ultimate applicability of the Benson principle in steam generation, but a lesson can be learnt from the fact that the inventor did not come from the ranks of power-plant engineers, and might have been and doubtless has been classed as an amateur dabbler in chemistry and engineering. Specialists are usually too close to their jobs, and it is sometimes true that the looker-on sees most of the game.

Opportunities for the development and exercise of constructive ingenuity are still too vast to define. The scope for invention increases with the growing complication of industrial effort and the urgent need for higher efficiency and lower production costs. It were stupid to ignore the fact that the mining industries are depending for continued success more and more on centralized effort and large-scale operations, as a result of which the number of engineers and consultants employed, in proportion to output, is steadily decreasing. To those who are possessed of training, experience, initiative, and imagination, but who may be temporarily unemployed, one can commend for serious consideration the multitude of secondary problems, inextricably involved in mining and metallurgical operations, the solution of which will have so favorable an effect on future success and expansion.

Adequate Intercourse and Industrial Progress

EARLY TRADE ROUTES by sea were planned for the transport of salt and incense, thousands of years ago. The same methods of conveyance, travel, and communication—by speedier and more reliable means, it is true—connect us with our South American and Central American neighbors and the overseas branches of American industry established in their countries. The fastest practicable existing method for postal communication, for personal journeying, and for the delivery of goods between South America and the United States requires two to three weeks. An air service is urgently needed for mail; but one must learn to walk before running, and airports are essential at intervals along lengthy airplane routes. President Coolidge's reported suggestion that a road should be constructed to link Maine with Chile therefore provides a sound basis for a more thorough analysis of the problem of improved communication. The very bigness of the proposal should not serve to damp enthusiasm. As Mr. Ford maintains, the most ambitious and apparently visionary projects can usually be subdivided into a series of smaller ones, each well within the scope of practical politics, scientific and engineering achievement, and financial support. Mr. Ford's dictum is especially applicable in regard to long-distance road building.

Our geographical position and a tacit acceptance of the Monroe Doctrine place us in a position of privilege and responsibility toward the nations to the south of us. Improved communication will foster closer personal contacts and a better understanding of international problems; it will dissipate ignorance of facts, and create a greater respect for national aspirations and racial prejudices. In time it may come to pass that writers and journalists will cease to refer to the citizens of the sovereign states of South and Central America as "natives." With a greater mutual respect will come abundant opportunity for profitable investment and systematized activity in developing those rich mineral

regions that do not already owe their existence as producing centers to the introduction of modern methods and labor-saving machinery. The economic future of the South American countries depends in large measure on the degree to which international co-operation may be secured.

The Baltimore & Ohio's Centennial

A REMARKABLE EXHIBITION of a century's progress in land transportation closed recently in Baltimore, where "The Fair of the Iron Horse" marked the completion of a hundred years of successful railroad operation by the Baltimore & Ohio, America's oldest road and one of its greatest coal carriers. On tracks specially laid for the occasion, a daily pageant passed: first, cars pulled by horses; then a horse operating a treadmill placed upon a car; then sails for motive power; and finally, as in 1829, the first American locomotive, built by Peter Cooper, and fired by wood, as in the old days. It weighed only two tons, with a vertical boiler, and cylinder and piston on the side, attached to a crank for turning the wheels. This was improved a year or two later when the first "Atlantic" locomotive appeared, the original model still being able to pull two or three of the quaint little stage coaches on wheels, as all who attended the fair can attest. In 1837 appeared the first locomotive with a horizontal boiler, looking more like the modern locomotive except for its huge smokestack and diagonal cylinders. Then followed in the pageant thirty or more models, down to the latest types of today, including one from England, two from Canada, several from competing railroads in the United States, as well as types used on the B. & O. Of special interest was a new water-tube boiler locomotive of the Delaware & Hudson company. The sight of this long line of engines, each under its own steam, from the earliest models to those of today, with many drawing contemporary types of cars containing passengers dressed in the costumes of the same period, was thrilling.

Accessory exhibits were numerous, even extending to the economic and social aspects of railroading. The Baltimore & Ohio, although maintaining its prestige, has been outstripped in importance by the New York Central and the Pennsylvania, but it has a spirit of service that makes a trip on its lines a more than usually pleasurable experience for the passenger. This is partly attributable to the close co-operation between management and employees. Its accomplishment in this respect is perhaps the most important contribution that has been made in recent years to bridge the gulf between Labor and Capital, to foster efficiency and happiness. The B. & O. system of "union-management co-operation" has been adopted by the Canadian National and the Chicago & Northwestern, with great success, and has attracted much attention in the last year or two.

The metal-mining industry comes in little contact with this particular railway system, but is intimately associated with rail transportation in general and very much dependent upon the progress shown so vividly in the Baltimore exhibition. More than half of the domestic railroad tonnage consists of mine products; much of this is, of course, coal, but ore and metal are also carried in large quantity. The Utah Copper Co., for instance, ships by railroad more than 30,000 tons a day. The extent to which mining companies are engaged in railway transportation is not generally realized. Even small properties usually have many miles of narrow-gage track, underground and on the surface. The larger ones have standard-gage track, with real locomotives and rolling stock. Some own or control regular railway systems for the transportation of passengers as well as freight.

It is regrettable that all mining men were not privileged to see the Baltimore exhibition, for it contained much of interest to them professionally. The B. & O. is to be congratulated on what it has done in the last hundred years, epitomized in this striking exhibit of transportation progress.

The "Copper" Shares

B. C. FORBES, interesting if not always entirely accurate, observer and prolific financial writer for a syndicate of newspapers, on Sept. 30 published an article showing that the oil and copper shares had not joined in the recent prolonged advance in the stock market, and purporting to prove that as a matter of fact they were selling at lower levels than a year ago. So far as oil is concerned he probably is right; but his point is not well taken with respect to copper. Even his own table disproves his contention if it is subjected to a little dissection. He lists seventeen mining stocks, together with current quotations and those of one year ago. He then remarks, "Of seventeen copper stocks only six are higher than at this time last year."

The first trouble with Mr. Forbes' argument is that his list includes five mining companies that are not "coppers." Dome Mines, Nipissing, Butte Copper & Zinc (in spite of its name), Butte & Superior, and Hecla produce gold, silver, lead, and zinc, but virtually no copper. Butte & Superior, it is true, found some copper in its lower levels; but it is not shipping copper ore now, and by no stretch of the imagination could it be classed as a copper property. Leaving these out of consideration and also those companies in Mr. Forbes' table that he shows to be unchanged from a year ago, there remain five—Tennessee, Miami, Cerro de Pasco, Calumet & Hecla, and Anaconda—that have declined; and six—Calumet & Arizona, Granby, Greene-Cananea, Magma, and Kennecott—that have risen in value. The sum of the increases is 85; that of the declines only 13.

A more accurate view of the copper-share situation may be obtained from the "Index of Copper Share Prices" prepared by and published monthly in the *Engineering and Mining Journal*. For September, 1927, this index number was 117.6, compared to 105.6 in 1926 and 101.2 in the corresponding month of 1925. In saying that copper shares are selling at lower levels than a year ago Mr. Forbes makes a generalization that will not hold water. But when he says coppers have not risen "dizzily" as have the industrial railway and utility shares he is quite right. The reasons for this are by no means obscure. With the copper mines of the world equipped to produce more copper than is required at present the price of the metal has sagged, profits of many mining companies have dwindled, and the shares naturally have not advanced so much as have other groups in the market. Time will remedy this situation, however, as the demand for copper increases to a point justifying a further increase in output.

Manganese Resources and the Proposed Emergency Stock

IN DEFENSE of the present tariff on manganese ore the *Engineering and Mining Journal* has urged that the domestic industry must have this protection if it is to develop to such an extent that the government may depend on it for manganese to meet war-time needs. It has been pointed out that such a growth is possible only by development and utilization of the country's large resources of manganese ores of less than ferro grade. This, in turn, it has been shown, is dependent upon research. Remove the tariff and you will kill research.

Results of research of great importance have become common knowledge since the question of the tariff was first opened last April at the Cleveland meeting. It has been demonstrated that by nodulizing and electromagnetic separation a product acceptable to ferro makers can be made from the manganese carbonate ores of the Pacific Northwest. This, however, is commercially possible only if the tariff be retained. Believing that no step so foolish as the removal or lowering of the tariff will be taken by the government, important interests have undertaken to beneficiate these ores. Other research plans and development projects are also under way.

In defending the manganese tariff against those who seek its removal the *Engineering and Mining Journal* has been actuated by the belief that the welfare of domestic producers, struggling with problems of beneficiation, should be considered; and that the development of a domestic manganese-mining industry should be encouraged as a war-preparedness measure. Furthermore, inasmuch as research is often protracted, and the development of an industry is something that cannot be accomplished overnight, we believe that an emergency step should be taken without delay to insure an adequate manganese supply—that is, if there is any meaning in preparedness. Although it may be hoped that war between this country and a power able to cut it off from foreign sources of manganese is a remote contingency, nevertheless a program of preparedness must assume that war may happen at any time. This journal, therefore, has heartily seconded the proposal that the government accumulate over a period of six to nine years a supply of manganese ore, of the proper grade and analysis, sufficient to meet the steel requirements of the War and Navy departments in a war of one to two years in length. It has further urged that, in making these annual purchases during the period stated, preference be given to domestic manganese, if it can meet government specifications.

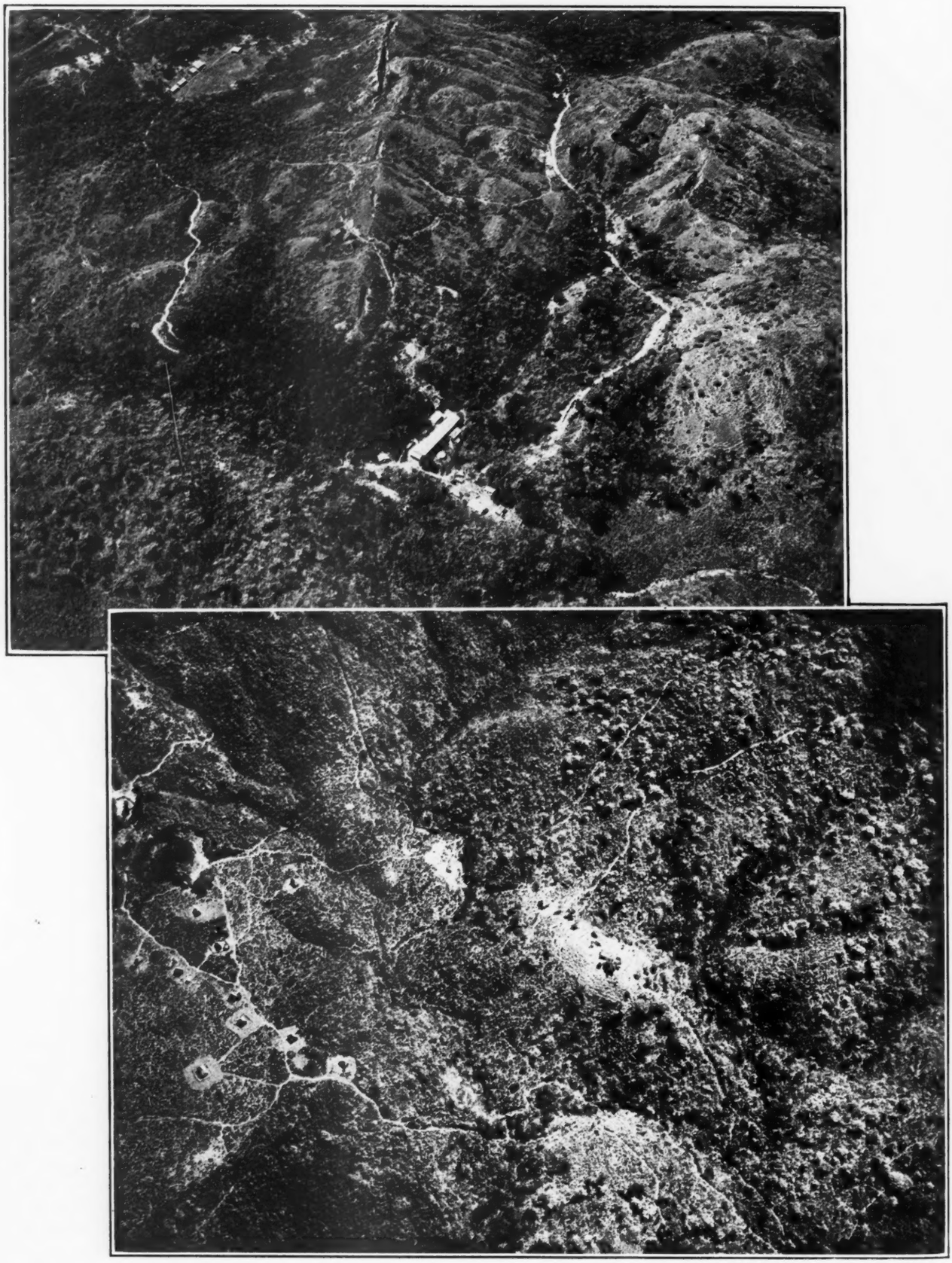
The proposal that a stock of manganese ore be thus accumulated was originally made by a joint committee of the A.I.M.E. and the Mining and Metallurgical Society of America. In supporting this recommendation there is no implication that the United States lacks or possesses only negligible reserves of manganese; but, rather, it is an indication of a firm conviction that undeveloped resources can be brought to production only by allowing an appreciable period of time. Dormant domestic reserves of manganese will not safeguard the steel industry against a war emergency. Should war break out, the interests owning these dormant reserves would need a year or two to open them and start production, even if a War Priorities Board placed them first on its list to receive labor and supplies. This is something that any experienced miner will comprehend. The reserve left dormant will most likely be unprospected also, save as to its surface indications; so the chances of getting tonnage speedily upon the outbreak of a sudden war will be even more remote. This also is something that an experienced mine superintendent will readily understand.

Separate Flotation Treatment for Slime

ONE of the greatest advantages of the flotation process is an ability to recover the valuable minerals in slime, which otherwise would go to waste with the mill tailing or would be concentrated with indifferent success on slime tables or vanners. However, large quantities of such slime are the cause of indifferent results, whatever the concentration process adopted. Some ores contain much *primary slime,* or slime present in the ore as mined. Generally speaking this should be removed and treated as early in the milling operation as possible, because it interferes with grinding efficiency and metallurgical extraction. Excessively fine slime is also produced during grinding, the amount depending upon the ore and the character of the grinding operation. When occurring in quantity, consideration should be given, also, to its removal and separate treatment; for then the flotation control may be adjusted so that the best recoveries and the highest grade of product may be made, and, furthermore, the best conditions for dewatering and filtering may be obtained. It may even be preferable, in some instances with unusual local conditions, to filter a small amount of slime concentrate and, separately, the remainder of the concentrate that is substantially free from excessively fine material, than to filter in one operation the mixed concentrate. An increased capacity and drier cake may thus be made. This segregation and separate treatment of pulps by the flotation process has resulted in important economies at several plants, notably that of the Bertha Mineral Co., in Virginia, and at the Britannia mill of the Howe Sound Co. It is one of the refinements of flotation operation that is well worth investigation at all mills that have appreciable quantities of slime in their flotation pulp.

Vieille Montagne's Example

THOUGH the larger mining companies in the United States have spent much time and money on welfare programs, no one of them has gone to such generous lengths as Vieille Montagne, of Belgium. This mining and smelting company, which in 1926 was responsible for almost 8 per cent of the world's zinc production, set apart more than 15 per cent of its profits in the same year for social work. These profits amounted to 53,964,000 francs, in round numbers, of which 8,500,000 francs was marked for employees' pension funds and other benefits. Of this sum 1,500,000 francs was to be used to supplement, where necessary, the bonuses given retired employees, in order to meet the increased cost of living. Besides this, special allowances are made for births and funerals, and since 1922 family allowances have been distributed because they constitute "together with the institutions connected with them one of the most efficacious measures towards social pacification."



Photos taken by U. S. Army Air Corps

Above, the Remance mine of the Panama Corporation, near San Francisco de Veraguas—a gash in andesite 9,000 ft. long and filled with white quartz. Below, another mine in the same region. Note the wealth of detail caught by the sensitive air camera

Panama From the Air

Is Mining to Thrive Again in Panama?

By G. C. RIDDELL
Mining Engineer, 233 Broadway, New York

GUY C. RIDDELL

FOR a country that is squarely on the beaten path of commerce, Panama, considered as a land of human beings and natural resources, is one of the least known regions of the globe. Panamanians themselves, 400,000 of them, go about their own country practically not at all. Merchants of Colon and Panama City, spending their lives in the city, seldom — usually never — go fifty miles from their front doors. Centuries ago—in the sixteenth and seventeenth—hosts of Spaniards and goodly numbers of English rovers and pirates penetrated the country in the quest for gold, and in the last quarter century a few hundred Americans and Englishmen have gone back into the heart of the country on timber, mining, and political objectives. But the Republic of Panama, fifty miles east and west of the Canal Zone, remains, by and large, a land of hearsay and conjecture.

Thus it is, when the subject of mining and minerals in Panama is mentioned in any normal gathering of U.S.A. mining and business men, that blank and vacant expressions of countenance result.

"Panama? Let's see, that's where the Canal is. I know all there is to know about Panama, and it isn't much. Niggers, bugs, and fever! It's the sort of place the *National Geographic* and the *Literary Digest* dig up once in a while—good reading—but don't expect me to take any stock in real business down there. Why, it's been right there in the same place ever since Columbus discovered America, hundreds of years ago, hasn't it, and you want me to get excited *now!* Come to think of it, they *have* gotten gold and platinum in Colombia on the South American side, and, now that you mention it, there is a lot of gold coming out, right along, from those checkerboard countries at the west end of the Isthmus—Costa Rica, Guatemala, Honduras, and so on—but who ever heard of any real mines in Panama? Oil, either—there's plenty of oil in Colombia and Mexico, but it seems to me that I've heard Sinclair and the Gulf Oil are about licked on their wells in Panama—seems to be a wash-out. No, Panama's just down there to keep the oceans apart; it's got a lot of trees and monkeys, and hats, some boa constrictors and butterflies, and it has a jolly little weekly lottery, with cock fights and a revolution once in a while. But mines? I should say not! Too late in the day to spring *that!*"

This is, I venture to say, the way ninety-nine men out of a hundred react to the word "Panama." It is, anyway, what I have noticed here in New York on the part of many who go up and down the world. In Panama, the spotlight plays always on one strip. This strip is, of course, the Canal Zone, ten miles wide, a spot strongly illumined, with its contents standing out in sharp, clear brilliancy; outside the illuminated zone, a vague, dim region of no particular interest to anybody and not intended for the spectator's scrutiny.

Now, as to the facts. The climate of Panama is certainly not hard to take to. In the dry season—December to late April—it approaches the ideal. Cool nights always, and days not at all difficult. The thermometer seldom goes above 85 deg. in the shade or falls below 75 deg. In the Zone, a year's temperature averages 80 to 81 deg., and it is a peculiar fact that 80 to 90 deg. on a tropical thermometer is about the same, in its effect on the human being, as 70 to 75 deg. in northern latitudes. This differential is remarked by every visitor to Panama. The rainy season is far from the dolorous affair expected. The sun shines practically every morning, rain falls from 1 to perhaps 3 or 4 o'clock, and the sun shines again.

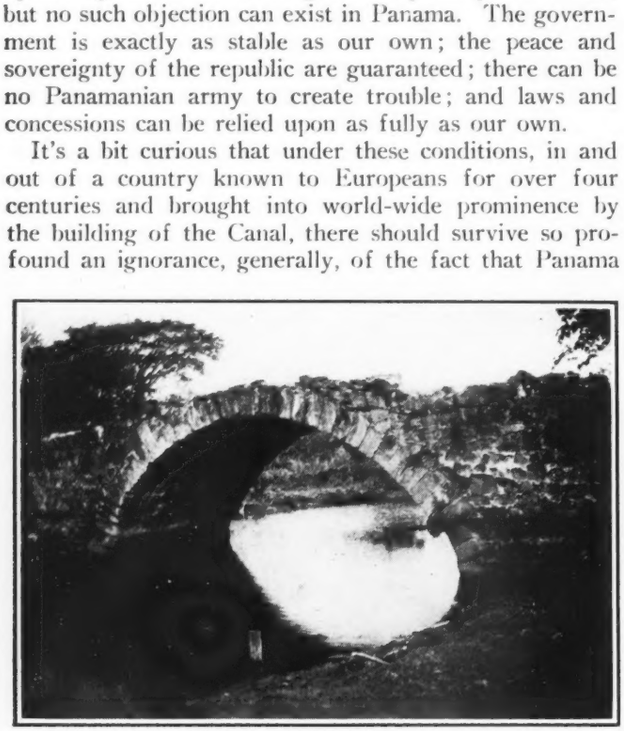
The Canal Zone is most effectively cleaned of mosquitoes by American vigilance and oil, and Panama and the Zone today are entirely normal as to fever and general health conditions. Panama is actually taking on rank as a health resort; its tourist travel includes steadily increasing numbers who are not merely globe-trotters.

As a people, the natives are courteous and kindly, and no matter how far into the interior one penetrates they are found, with the exception of a couple of remote Indian tribes in Bocas del Toro and Darien, ready always to extend hospitality and to guide and break trail for the traveler. They are, however, fearfully lazy; the great national pastime is sitting down. A few hours' work each day keeps body and soul together; winter has no terrors. Result: a mild, gracious people, and on the whole, outside the Zone, an idle, undeveloped land.

As to revolutions, the U. S. Army maintains some 17,000 troops in the Canal Zone, and practice marches to the interior are frequent. The only revolution that can occur in Panama these days is the revolution of an hour, or a day—a gesture most unlikely, but in any event instantly quelled by a kindly power that is committed to certain control of the "Bridge of the World." A stronger military situation does not exist than Uncle Sam's devices

for control of this entire region. Generally, investment in Latin-American countries faces a factor of unstable government, with the uncertainty of one political faction upholding the concessions granted by its predecessors, but no such objection can exist in Panama. The government is exactly as stable as our own; the peace and sovereignty of the republic are guaranteed; there can be no Panamanian army to create trouble; and laws and concessions can be relied upon as fully as our own.

It's a bit curious that under these conditions, in and out of a country known to Europeans for over four centuries and brought into world-wide prominence by the building of the Canal, there should survive so profound an ignorance, generally, of the fact that Panama



Morgan's Bridge on the old Gold Road, Panama

possesses resources and natural advantages which make it potentially one of the richest regions in Latin America.

Geographically, its position is ideal; every part is near tide-water and in direct all-water communication with every part of the world. The explanation of this backwardness is, primarily, the fact that all through the centuries the Isthmus has been used as a short-cut from ocean to ocean, with attention and development confined to the ports at either end of the route and all energies and commercial interests applied to this cross traffic.

Panama's Gold

Hundreds of years ago—three and four hundred to be exact—gold came out of Panama to quite a merry tune. Millions of it went to Spain, freighting the Spanish galleons that baited Esquemeling, Sir Henry Morgan, Sir Francis Drake, William Parker, and the long line of buccaneers whose exploits have given us the romance of the Spanish Main. The old Gold Road of Panama, winding across the Isthmus just east of the Canal—Bolivar's "Bridge of the World"—provided fifty miles of torture for the slaves and prisoners of the Spaniards, groaning under loads of Aztec and Inca gold, and gold from the Panama mines of Veraguas Province. Incidentally, every piece, every ounce, of the gold of those days was gold that had been concentrated by nature into free gold; when sulphides came, mining had ceased.

Down to 1670, this native accumulation of gold from the mines of Veraguas and Darien flowed in vast amounts to the coffers of Spain, and wealth almost beyond calculation came from Mexico, Ecuador, Peru, and Bolivia for export across the Isthmus over this famous Gold Road. Great fleets of galleons rode at anchor in the harbors at Porto Bello and Nombre de Dios on the Atlantic, and Old Panama at the Pacific end. The agonies of the Gold Road continued for a century, until its rich cargoes lured the pirate Morgan in 1670 to leave his ships at the mouth of the Chagres and venture across the Isthmus on foot with 2,500 men. Arriving at his objective, Old Panama, he sacked the city and got away with some 200 mule loads of gold, silver, and precious stones, as well as scores of women and girls. The ruined city was never rebuilt, the inhabitants moving some six miles north along the coast to the present site of Panama and Balboa, founded Jan. 1, 1673. Thereafter, except for unsuccessful attempts to wrest the country from Spain and continued depredations by the pirates on the Atlantic seaboard, during the next twenty-five years, Panama passed into a more or less peaceful and barren century, during which, nevertheless, mining for free gold kept steadily on. Among the mines contributing to this flow of yellow metal to Spain, before and after the sack of Old Panama, a few stand out in striking character.

Columbus himself was a gold-digger of Panama. On his fourth and last voyage, Christopher and his brother Don Bartolome first sighted the shores of Panama, and in May, 1502,[1] anchored in the bay now called Almirante in his honor. Hearing from the Indians that their stores of gold all came from a neighboring region called "Veragua," Columbus cruised east along the coast, founding a town at the mouth of the Belen River which he called Santa Maria de Belen. Great quantities of gold and ropes of pearl were obtained from this base, and Columbus wrote to the Spanish king, "I have seen more gold in a day here than in Española in one year." Veragua was made a Dukedom and the title of Duke of Veraguas is held by the descendants of Columbus to this day.

The Gallo Mine

Local rumor has it that slaves of Columbus a few years later, in 1510, penetrated to a gold deposit in Herrera Province, some 80 miles south of the Atlantic coast, establishing a camp which later became the town of Las Minas. Here they, or later arrivals, scalped the crest of the old Gallo hill, leaving a great glory hole, 150 ft. in diameter, at the very top of the mountain. From 1510 to the nineteenth century various Spanish companies continued the attack on the Gallo hill, carrying away upwards of a million dollars in free gold, shifting their workings over the surface of the hill whenever they got down to the sulphides, for which they had no metallurgy nor machinery. Trenches run down the sides of the hill, more or less radially from the top, from which great pockets of free gold were gouged. Rich pockets were uncovered through the years down to 1826, when with the Revolution all mining in Panama ceased.

These Gallo surface pockets were apparently not the *manta* deposits that have led to so many gold fiascos in the tropics. The sulphides of the Gallo, encountered all over the hill close to the surface, are themselves of good grade, in some cases very rich, and have not been found in positions which would give rise to manta accumulations.

There is, somewhere in this old hill, as yet untouched, the feeder—a sulphide pipe, or vein, of good proportions, that is the backbone of the extensive mineralization. By

[1] A few historians have it that Panama was discovered a few months before Columbus' arrival, by Bastidas, who sailed from Spain in October, 1501.

gradual elimination of other theories, in prospecting that has continued during the last few years, a volcanic chimney at or near the central axis of the hill has been deduced. It is now planned to extend one of the five existing tunnels, 250 ft. further into the hill, where it will strike the vertical axis.

The Caña Mine

Much of the same type of orebody as is believed to exist at the Gallo hill has gone into history a few hundred miles to the east in the Darien country. Opened in 1680, the Espiritu Santo, or South Caña mine, had in 1684 become known as the richest gold mine yet found in America. In the *E. & M. J.* of Dec. 25, 1926, quoting as authority a report by Governor Andres de Ariza to Viceroy Guiror, in the archives at Bogota, it is stated that by 1727 $30,000,000 had been taken out of the Espiritu Santo above the 250-ft. level. Spanish reports show that in one year the government received as taxes the equivalent of $284,000. This indicates that the total output for that year must have been $873,000, as it was customary for Church and State to exact heavy tolls—one-fifth to one-third. The Caña mine was captured at various times—1684, 1702, 1712, and 1724—by pirates who worked the property to the best of their abilities. In 1727, an aboriginal uprising occurred, and this, in connection with the caving-in of the mine, so discouraged the owners that they never returned from Panama City and Cartagena, to which they fled under attack by the Indians.

The revival of the mine was attempted in 1853 and in 1880, and in 1887 the Darien Gold Mining Co. was formed to take hold of the property. This group spent nine years organizing, prospecting, and milling low-grade ores from the North mine before the old Espiritu Santo was accidentally rediscovered. From 1899 to 1903, inclusive, shipments of bullion were $2,000,000,[2] and the mine was then down to a depth of about 500 ft. From 1903 to 1911 the history of the Caña mine was one of gradual decrease in grade. Discussing conditions of the property with its last manager during my stay in Panama City, I was told that grade at the levels near the 500-ft. point became so low that further working was considered impractical.

The Caña orebody is described as a prismatic chimney, formed at the intersection of two fractures in andesite with a horizontal cross section roughly 100x 100 ft. and inclined about 18 deg. from the vertical. This shaft of ore is about the same dimension as, and possibly a little smaller than, the volcanic neck indicated in the Gallo hill by the glory hole at its top.

Lost Mines

Sixteenth-century Spanish history relates the mining exploits in Panama of the Duke of Pachatal, a Spanish nobleman who, ruined in Spain, came to the New World with three ships, landed on the coast, and forced an Indian captive under torture to disclose the tribe's gold mine. The mine was worked for a year and a half by Pachatal, and was of such proportions that he returned to Spain leaving a garrison of fifty men to carry on at the mine until he could return with a larger force. He came back with a fleet of ships later to find his fifty men massacred and the mine obliterated by the jungle. Today its location is unknown and not even a rumor points to its whereabouts, but its story is still passed along by the old-timers.

The Lost Padre mine, somewhere in Veraguas, is but another of the score of rich mines incompletely worked in Panama, now lost in the jungle. This was a Church property in lower Veraguas in which eight or ten priests were, in the seventeenth century, buried by a cave-in. It was forthwith condemned and sealed by the Church as accursed. Only its approximate location is known today, and the jungle is so dense for miles about that only a miracle of chance will ever uncover it. It lies somewhere at the center of 1,000 square miles of mining concessions recently granted to an American in lower Veraguas.

Both east and west of the Canal Zone are one or two tribes of Indians, in remote districts, who strongly discourage strangers inclined to penetrate their territory. About the headwaters of the rivers along the Costa Rican border dwell the Shayshans, or Palenques. Rumor has it that the ancient Tisingal—one of the early gold mines of the world—is in the country of these Shayshans, who do not wish it rediscovered.

And so it goes. At the old Cañaza mine, near the Colombian border, the Spaniards, unable to work the rich sulphides, packed them in clay and salt, left them for a year or two, removed them thereupon in more or less oxidized form and extracted the values. The Cimarrons killed off the Spaniards, and the mines are lost. Maurice Hooper, who has mined and prospected in Panama for the last forty years, believed he had found the Cañaza dumps at one time, but as his men were shot down by the natives, his enthusiasm for this ancient form of metallurgy and source of wealth went into an abrupt decline.

In the northeast corner of the Ocu concession, at Cerro Negro, is—or was—the first silver mine of record in the Americas. Silver from this rich property, now obliterated, was coined into pieces of eight at the old mint at Nata, a town which lays claim to being the oldest inhabited town on the continent, having been founded in 1519. The slag dumps of the Cerro Negro mine have been located, but the deposit itself is yet to be found.

A one-night stand in Veraguas. The hostess has other responsibilities than guests

A Sketch of Panama's Geology

The geology of Panama, outside of the Canal Zone strip, has had but little attention. The Cordilleras of the main range at one time interposed but ten miles of terra firma between the oceans; elevation and subsidence have gone on through the ages, until the Isthmus now, at its narrowest part, is approximately fifty miles wide.

[2] *E. & M. J.*, Dec. 25, 1926 (Sheridan).

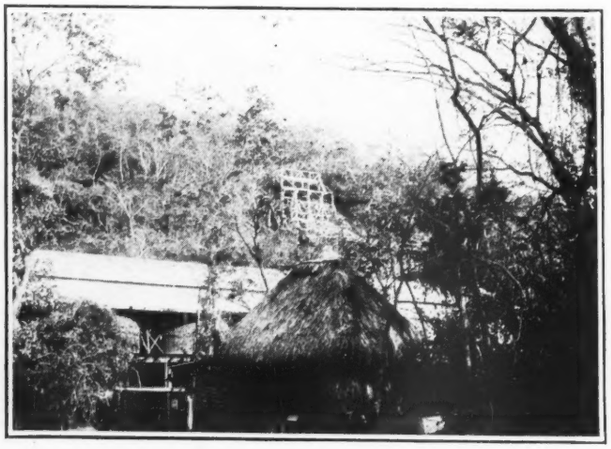
The oldest rocks are andesitic. Resting on these are, on the Atlantic side, fossiliferous conglomerates, sandstones, and shales, dipping at low angles toward the Caribbean Sea, so that in passing from the interior toward Colon (at Atlantic end of the Canal) successively younger beds are encountered. The oldest are Eocene; the youngest, late Oligocene (W. H. Dall). On the Pacific side, the Eocenes disappear under beds of acid pyroclastics. The sightly Ancon Hill, at Panama City, is a rhyolite porphyry intrusion. Cutting all rocks at innumerable points in the Canal Zone are dikes of pyroxene, andesite, and basalt. The youngest rocks of the Zone region are Miocene.

West of the Zone, through the back country of Herrera and Veraguas, with which I am familiar south of the Cordilleras, the terrain changes abruptly and frequently from sedimentaries to igneous rocks, the latter often of very considerable area. These rocks are, as far as noted, of the fine-granular or porphyritic class, showing more rapid crystallization than that which occurs in slowly consolidated plutonics. In the former (the class prevailing in Panama) ore depositions are usually of the higher (lower temperature) zones, as contrasted with deep-seated (higher temperature) magmatic segregations of true plutonics. Copper deposits are, frequently, characteristic of such igneous extrusions as the Panama areas contain, together with zinc and lead; and the upper gold-silver zone is highly characteristic.

Prospecting Difficult

It is extremely difficult in Panama to get about the interior, when the traveler leaves the beaten trails. It is a case, usually, of saddle instead of auto, and often of foot instead of horse. Panama mineralization is perfectly obvious if you take time to look, but it is obvious only if you do take time. It is a mañana land, Panama, and you don't see things in a hurry. The metals—copper, gold, iron, manganese, platinum, lead, and zinc—are existent in widely extended areas; it remains to be seen what these deposits will show as to depth and working grade.

During the nineteenth century mining in Panama has been practically at a standstill. With one exception—the operations of a British company—no systematic prospecting or exploration is going on today. The country is so densely jungled in most of the mineral areas that the only ores that come to light are those brought in by natives who in their movements through the jungle are intrigued by "strange rocks." It is to be remembered that in Panama, prospecting by ordinary geological methods is practically out of the question. The country in places is so thickly timbered that an outsider or occasional mining visitor would seldom if ever detect mineralization. One is dependent on the hundreds of streams that cut through to the sea for geological data.



The cyanide plant at the Remance mine

West of the Canal there is considerable open country, and in certain parts of this open country—Veraguas and Herrera provinces—are rugged outcrops that he who runs may read. Practically every ore deposit known today in Panama, however, has come to light by the native method, a steady stream of rock specimens coming into the towns from natives who tell of "large" deposits. These reports, though interesting, are by no means trustworthy, as the average native always sees large bodies, generally where they do not exist, and his alarm is only regarded as an indication that the deposit should be visited if and when convenient. Once visited, over trails that must be slashed through the tropical growth, these deposits must be well marked and carefully located, for the undergrowth comes back fast, and the trail disappears in new jungle almost before a ten days' journey ends, and always the visit must be on foot. Nine times out of ten the size of the deposit proves disappointing, but out of scores of deposits discovered in native fashion there have been, in Veraguas and Herrera, some extensive mineralizations, notably copper, iron, gold, and manganese, that have been followed up and given preliminary examination by Americans long residents. They have been sufficiently attractive to warrant their taking up, in three concessions from the government totaling 1,400 square miles of mining areas, which include other deposits within knowledge but awaiting examination.

The Spaniards of the sixteenth, seventeenth, and eighteenth centuries simply topped the country, cleaning it to a great extent of its free gold. They worked the rivers but left rich spots. They never went below surface water nor into the sulphides. You can stop at any of the rivers and pan colors. On one bar in the Rio Cobre two men a year or so ago took out $6,000 in two weeks. Panama's skin of green jungle has but few scars. Wherever the scratch has been a bit deep it has been decidedly worth while.

The Panama Corporation

In all Panama today there is not one custom assay office, and there is but one serious, large-scale mining operation under way. This is a British undertaking, the Panama Corporation, Ltd., with a £2,000,000 capitalization, £1,000,000 of which is issued. It is opening up and blocking out gold, lead, zinc, and gold-platinum areas in its 1,100-square mile concession in Veraguas and its 3,500 square miles of alluvial grant east of the Canal Zone. It holds in these two concessions about one-sixth of the total area of the Republic of Panama, and has just increased its territory by another option (August) on 100,000 acres of alluvial ground in Darien. There was more or less excitement in Washington about this Panama Corporation's concessions a few years ago, but the hallucination that it was a mining smoke screen for British rubber has been finally laid to rest, and the mining operations of the company have been getting on, in spite of skepticism and criticism on both sides of the Atlantic.

It is more or less well understood in Panama that the corporation's operations are still of a development na-

ture, and that it may be some time yet before substantial production is made. Meanwhile, tunnel driving and shaft sinking go steadily on, and measurement of ore reserves proceeds toward the end that power and concentrating equipment of proper size may be installed.

In its concession east of the Canal, the company is developing a gold-platinum area. The impression prevails in Panama City that a good-sized operation is slowly coming into being in this territory, and that both the platinum and the gold values will be needed to make it a go. I have not visited these areas east of the Canal, but gathered from miners and workmen returning from the field that it is no bonanza, but rather a solid operation.

On its new 100,000-acre option, secured in August from the old Darien Gold Mining Co., covering gold alluvials in the Cana River country, eastern Panama, the corporation is reported as starting development work in September of this year. These newest activities are in addition to those on the 4,600 square miles of concessions from the government on which it has been working in Veraguas and Darien for several years. The new option runs until 1930; engineers and equipment left London in August to prospect this area of some seventy-one mining claims thoroughly. The region has been idle since 1915.

The Remance Mine

I visited the corporation's Remance mine in April. For 8,800 ft. along the ridge of a line of andesite hills is a gash 4 to 8 ft. wide filled with white quartz. (See the airplane photo.) It is not a contact vein, but is apparently an opening developed largely by magmatic pressure. The vein is almost vertical and strikes N. 20 deg. W. At the north end of the 8,800-ft. outcrop are three fissures to the west, converging toward the main vein; at the south end four fissures lie east of the vein, converging also toward the lode. Among these, the Guatia Lode is almost equal to the Remance; it is 3,600 ft. long and 2 to 4 ft. wide.

The Remance vein had an old rhyolite capping, now eroded; the country rock is andesite, and considerable white, compact, fine-grained tufa or Tertiary volcanic ash is in evidence. The andesite is believed to go down not more than 700 ft. What will be found below the andesite is conjecture, but a good-sized mine has already been blocked out above the fifth level. On this level, 115 ft. below the bottom of the vertical shaft of the original Veraguas Mining Co., the new company has drifted over toward the vein in expectation of cutting it at this level, which is 385 ft. vertically below the top of the shaft. The old Scottish company had four levels driven to the vein, one at 60 ft., one at 120 ft., one at 180 ft., and one at 270 ft.

The vein was reached by the company on the new fifth level in April of this year. In his published report, V. F. Stanley Low, consulting engineer, stated in June that a north drive had been carried forward in the vein 21 ft.; a south drive 40 ft. Both are in payable ore, running 19.46 dwt. gold over a width of 58.28 in. and a length of 59 ft. Since Mr. Low left Panama, J. J. Calderwood (the resident engineer in charge) reports that the drive north has continued in ore of better grade. In Powder House Hill, at the south end of Remance Lode, the No. 2 level has (August) entered the body of good ore discovered at the crown of the hill. This body in No. 2 is being opened up over a 30-ft. width, running $8 to $30. The reported values have not been personally confirmed, but have been received in recent communications from the company's engineers in Panama.

The Remance vein alone gives the Panama Corporation an important property. The vein is carrying better ore below surface water level than was found in the surface workings. Much of the mining can be carried

At the Remance mine. The tunnel enters the hill outside the picture at the left

on through adits, which will drain the lode and avoid pumping and hoisting. In the preliminary examination of the Remance orebodies as described in J. J. Calderwood's report to the directors in April, 1926, about 1,000 samples had been taken which averaged $5.76 per ton. The vein must be proved at other points along its length, and it will be explored at greater depth. The company has exercised its option on the property, and is forming a subsidiary to operate, a floatation that will in all probability be carried through in England in September or October.

The old Glasgow company (Veraguas Mining Co.) twenty years ago attempted unsuccessfully to cyanide the Remance ore. It is hard rock, and the Veraguas operators dry-crushed it only to quarter mesh, extracting $1 in gold and leaving $6.50 in the tailing!

The present company has 500 to 600 men at work in its six or seven camps, 50 to 60 being at the Remance property. Remance is south of the Cordilleras. A mule trail, for animal transport of supplies, is now being cut across the range to the Atlantic side of the divide, where three gold-zinc-lead veins are under development by the company near Chucu. Two alluvial deposits are also under exploration on the Atlantic slope, in this same Santa Fé mining district, a region from which the Spaniards gathered much of their gold, working, without pumps, only down to the surface water level. Great quantities were taken out at the mouth of Conception River, where ages of concentration have been at work, but here also the Spaniards only went to surface water level.

The work in Veraguas is in the immediate charge of Resident Engineer Keeler and the general direction of operations is in the hands of J. J. Calderwood, who has guided the work in Panama since its start.

All through the gold regions of Veraguas there is an association of the metal with copper rather than with galena or pyrite. In thousands of assays it has been found that it is the copper samples that carry the gold. The higher the copper the better the gold.

Near San Francisco de Veraguas a copper-lead-zinc gold vein has been under development for the past six

months. It was reported by workmen from the Panama Corporation property that in March of this year a 6-ft. vein was opened up, in which an assay of 24 per cent Pb, 35 per cent Zn, and 3.5 per cent Cu had been obtained.

Within 10 miles of the Remance vein, there are two water falls on branches of the Cañazas River, affording a 1,000-ft. drop (1,500-ft. head in a distance of two miles). The Cañazas River (erroneously labelled Cañacillas on existing Panama maps) is fed just above the falls by a drainage basin on which the rain never stops. This is one of the regions in which the "cloud

The Remance office

forests" of the Andes are found—timber growing in a rainy season which never ceases. Clouds hang forever about these upper peaks, shutting them off from view, and the entire terrain within the clouds is covered with a 6-ft. growth of moss over which one needs snowshoes to travel. Sinking into this moss, it would be difficult, wellnigh impossible, for a human being to extricate himself. Some 10,000 hp. is available at all seasons of the year—ample for the Remance operations and for the development of the Cobrisa Valley copper region, which also lies about ten miles southwest of these falls. The old town of Cañazas is about 18 miles distant by a trail. This power site is already denounced.

To be concluded

South Africa's Corundum Deposits

THE corundum fields of the Union of South Africa, according to a paper by C. J. N. Jourdan, presented at the Empire Mining Congress, are the most extensive and the richest in the world, occupying some 2,000 square miles in the Pietersburg and Zoutpansburg districts of the Transvaal. All the corundum so far discovered is of the common variety.

The corundum is produced from three types of deposits —crystal corundum, boulder corundum, and reef corundum. Crystal corundum consists of more or less broken crystals found in eluvial deposits, having been weathered out of and concentrated from the corundum-bearing reefs. It is from these sources that nearly all the corundum hitherto exported has been produced. Boulder corundum is the name given to aggregations of corundum crystals embedded in a plagiclose matrix. These masses or blocks, which are very resistant to weathering action, range from the size of a man's fist to several cubic feet. Reef corundum occurs in veins intrusive into the basic rocks, which in turn occur in the granites and gneisses which predominate throughout the corundum fields. The corundum-bearing veins or reefs are highly feldspathic plumasite bodies carrying a varying percentage of crystals of corundum, frequently as high as 45 per cent.

Blast Roasting Demands Carefully Controlled Conditions

A PAPER entitled "An Outline of Mining and Metallurgical Practice in Australasia" was recently presented at the Empire Mining Congress, meeting in Canada. The paper was prepared by leading authorities in collaboration. The authors state that the successful control of preliminary roasting must aim to create the following ideal conditions:

1. A thorough intermixing of the charge to facilitate chemical reaction between the different charge components.

2. A charge so constituted on thermal considerations that a sintering rather than a slagging reaction takes place.

3. A charge of such sizing that free passage of the blast is permitted equally over the whole bed. Heretofore it has not been found economically feasible to carry out the blast roast in one operation on the materials enumerated above. The following considerations will indicate the reason for this:

No matter how well the mixing operation is performed, it is obvious that every constituent cannot actually be in contact with a particle or particles of every other. Granulated slag, for example, is the coarsest constituent, and being used to the extent of 10 to 12 per cent of the charge only, complete contact is out of the question. The heat units in the charge would be sufficient to fuse it and render it impervious to the blast if all of them were liberated in the one operation, at a rate sufficiently high to be economical. Under these circumstances the operation would be brought to a standstill. The objects of the preliminary roast, therefore, are twofold, namely:

(*a*) To reduce the heat units in the charge to such an extent that the elimination of sulphur during the final roast to the extent needed can be carried out with the production of a good smelting sinter without risk of fusion.

(*b*) To bring the heterogeneous materials of the raw charge into such a state of combination that, after recrushing, the ideal conditions given above for blast roasting will be realized as closely as possible.

The concentrates themselves are too fine-grained to allow of a sufficient column of air passing between the grains to roast them. This is readily seen when attempts to treat them in the dry state are made, the charge being too impervious. Addition of water causes them to stick together, forming aggregates between which the air passes but which are not roasted right through in one operation.

Granulated slag, besides acting as a diluent, offers the following advantages:

(*a*) It insures more even porosity of the charge.

(*b*) Owing to its fusibility it tends to strengthen the sinter by acting as a cement agent.

Correct moistening of the charge is an important factor, as stated above. Sizing tests indicate that if dry, the charge would be too fine to allow penetration of the blast. The usual percentage aimed at in the preliminary roasted charge is around 6 per cent.

Flotation in the Treatment of Gold and Silver Ores: A Review

By M. W. von Bernewitz
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ALTHOUGH flotation is a growing factor in the treatment of gold and silver ores, it is doubtful whether, except in relatively few cases, the process will ever supplant cyanidation; but it would seem that by adding flotation equipment to the flow sheet in conjunction with cyanidation, some deleterious minerals may be removed and the subsequent extraction of the precious metals improved thereby. In the regular reading of the technical press and abstracting therefrom each year for *Mineral Industry,* I have noted the increasing use of flotation for the better recovery of gold and silver.

Prior to 1915 Charles Butters, of California; A. E. Drucker, of Korea; and W. B. Blyth, of Western Australia, had foreseen the future application of flotation to gold and silver ores and advocated experimentation therewith. Yet that is twelve years ago, and it cannot be said that the tonnage of such ores now dressed by flotation in any country amounts to a considerable proportion of the total treated.

This review first presents the opinions of certain metallurgists and then gives briefs of the literature on flotation of the precious metals in the principal producing countries.

Views of Metallurgists on Flotation

In referring to the operations of the Abangarez Mines, in Costa Rica, whose plant treats between 50,000 and 60,000 tons of ore a year at a cost of $4.56 a ton, Charles Butters said in *Engineering and Mining Journal* for Jan. 16, 1926:

> Flotation and treatment of the concentrates by cyanidation represent the methods employed. Without flotation this mine could probably not be profitably operated. It is also an example of what will gradually take place in the treatment of gold ores and gold-silver ores. The cyanide process has probably seen its peak, and gradually, as the flotation process becomes more widely understood, and its economies are developed, its use will increase. Especially in new plants, the question as to which process to install will be investigated more closely than in the past. Even in a region like South Africa, where the cyanide process is so firmly established, flotation will be gradually introduced, as its limitations are established by practice.

W. E. Simpson, in *The Mining Magazine* for February, 1926, remarked upon the similarity of research at Kalgoorlie (Western Australia) and Kirkland Lake (Ontario). Flotation (the bulk-oil method) was tried at the former center twenty-four years ago, when the process was not understood. He foresees that flotation may remove the refractory gold-bearing minerals from an ore and supply the necessary oxygen (by aëration and agitation) for subsequent cyanidation of the gold in the ore pulp.

In his review of the progress in ore dressing during 1926, in the *Engineering and Mining Journal* for Jan. 22, 1927, Charles E. Locke refers to the valuable aid flotation is proving in the more efficient treatment of ores where the gold occurs with sulphides of iron, often associated with arsenic and antimony. The experimental work on Rand (Transvaal) ore indicates that flotation may serve as an adjunct to cyanidation to increase the recovery of gold. Similarly, the testing of Kalgoorlie ore by flotation, followed by roasting and cyanidation of the concentrate, predicates a more efficient and economical process.

On the other hand, in reviewing the status of hydrometallurgy at the beginning of 1926, Stuart Croasdale, of Denver, in *The Mining Congress Journal* for February, 1926, considers that the cyanide process has become standardized and will probably remain so, and the only hydrometallurgical process for the treatment of gold ore for years to come. He did not touch on the flotation of straight gold and silver ores, but placed considerable stress on metallurgical adaptation to local conditions.

As to the statement occasionally made that flotation is detrimental to further treatment of the mill pulp, F. A. Beauchamp, in the *Mining and Scientific Press* for March 10, 1917, said that flotation is not in any way injurious to subsequent treatment of the tailing by cyanide.

In a brief review of the influence of flotation on metallurgical practice, F. A. Thomson, dean of the School of Mines at the University of Idaho, in Vol. 24 (1921) of the *Proceedings* of the annual convention of the American Mining Congress, held at Denver in November, 1920, said in part:

> In the treatment of gold and silver ores, flotation has not filled as important a place as its advocates predicted for it. Cyanidation, supplemented to a constantly decreasing extent by amalgamation, still holds the field. It is possible, experimentally, to show a high recovery of gold by floating certain ores. Generally, the gold, in part at least, is so finely divided that crushing ore through approximately 200 mesh is necessary for its liberation. . . . It is also true that many profitable gold mines are situated in remote places from which the transportation cost prohibits the shipment of anything but bullion, compelling the process to be one of ultimate extraction rather than of concentration. In the treatment of complex gold and silver ores which render the cyanide consumption prohibitively high, or from which no satisfactory extraction can be made, flotation has a field. In the case of oxidized ores of silver, where the primary sulphide ore is not amenable to cyanidation, it may be more profitable to sulphidize and then float the silver and other sulphide thus produced, than to erect a cyanide plant for the oxide ore and a flotation plant for the sulphide ore.

On pages 866 and 867 of A. F. Taggart's "Handbook of Ore Dressing" (1927), the following, in part, is given under Flotation of Gold and Silver Ores:

> When precious metals are intimately associated with base-

metal sulphides, or the precious-metal value is a sulphide, or in the metallic form and sufficiently finely divided and present in sufficient quantity or with a sufficient quantity of base-metal sulphides to stabilize a froth, flotation may be employed and good recovery made. Low-grade non-sulphide precious-metal ores cannot be treated by flotation because there is not enough metallic substance present to stabilize froth.

Flotation vs. amalgamation and cyanidation. The following summary accords generally with experience: (1) If amalgamation will recover any considerable portion of the precious-metal values, this part will be recovered more cheaply than by either cyanidation or flotation; the amalgamation treatment will not interfere with subsequent practice of either of the other processes, and should be installed. (2) Cyanidation requires a more expensive plant than flotation. (3) Operation of the cyanide process is, in general, more expensive than operation of the flotation process. (4) Cleanup and refining of cyanide precipitate is cheaper, per ounce of metal in the original ore, than the recovery of metal from flotation concentrate. (5) If the gold remaining after amalgamation is free—i.e., not associated with or included in sulphides—cyanidation will almost surely make a considerably lower-grade tailing than flotation; if the precious metals are associated with sulphides, flotation will probably make the better recovery and will probably, also, not require the pulp to be ground so fine as for cyanidation. This is because it is not necessary for the gold and silver in a sulphide particle to be exposed to the pulp liquid in order that they may pass into flotation concentrate, but it is necessary that they be exposed if they are to be dissolved in cyanide solution. (6) The base-metal sulphides may be extremely deleterious in cyanidation, and will certainly be largely wasted in a cyanide mill, while in a flotation mill they may add value to the concentrate.

Flotation of Gold Ore

The Practice in America

A perusal of U. S. Bureau of Mines Information Circulars No. 6022-6029, of March, 1927, which list and briefly describe the reduction plants (working or idle) in Oregon, California, Washington, Montana, Idaho, Utah, Nevada, and Arizona, respectively, during 1925, discloses a few flotation plants of generally small capacity in operation and a number idle. Very few of these plants are treating or have treated straight gold and silver ores; in nearly all cases the precious metals are associated with copper or lead minerals.

In America, according to Thomas Varley in Serial No. 2777 (1926) of the U. S. Bureau of Mines, the total amount of gold and silver ores dressed by flotation now approximates 485,000 tons a year, which is about 6 per cent of the total of 8,300,000 tons of such ores and tailings treated, and may be compared to 45,000,000 tons of base-metal ores floated in 1925. According to J. P. Dunlop in "Mineral Resources of the United States," 1925, a large quantity of concentrates from sulphide ores is now smelted, and the increased application of the flotation process has resulted in decreased yield of gold and silver from cyanidation, as nearly all such concentrates are shipped to smelters. In 1925 the approximate percentages of gold and silver extracted by cyanide were nearly 20 and 10, respectively, against 23 and 14 in 1924. Since 1914 there has been an almost steady decline in gold and silver extracted by cyanide; then it was about 31 per cent and 22 per cent; but the amount of gold recovered by amalgamation has risen rather irregularly from 21 per cent in 1914 to 31 per cent in 1925.

Most metallurgists are conversant with the many published items regarding flotation of gold and silver ores since 1914 and with the milling plants that were once equipped with flotation units, such as at Goldfield Consolidated, Nevada, and Vindicator Consolidated, Colorado, in 1916, and at Eagle Shawmut, California, in 1918, which had units of 500 tons, 300 tons, and 400 tons, respectively.

Methods Used at Cripple Creek

As early as 1907, according to one of those famous personal interviews of T. A. Rickard with noted Engineers, this one published in the *Mining and Scientific Press* for Jan. 22, 1910, Philip Argall made tests with the Elmore process on dump ore from the Independence mine, but found it unsuitable for the oxide ore, and subsequent recovery by cyanide was low. But at the Flotation Conference of the American Mining Congress held at Denver in November, 1920, and published in Vol. 24 (1921) of the *Proceedings* of the annual convention, Philip Argall stated that substantial progress is being made in chemical and mechanical research and practice and in a more careful preparation of ores for flotation.

The trend toward the production of somewhat higher-grade concentrate and high recovery favors coarse initial crushing, a bulky roughing concentrate, followed by one or more flotation cleanings of this concentrate, with regrinding of all middlings from the cleaning cells that are worth re-treating. Oil is not essential for good flotation, and there is a strong tendency today to dispense with its use. This prediction of Philip Argall is verified by what Thomas Varley, of the U. S. Bureau of Mines, says in Reports of Investigations No. 2777 (1926), where he maintains that the trend of treatment is "chemical flotation," not "oil flotation."

In 1916-'17 the Vindicator company reported that flotation in its 300-ton plant, treating mine and dump ore, gave recoveries of 81 per cent on $1.99 ore, 84 per cent on $2.26 ore, and 93 per cent on $5.40 ore.

In 1917 the Portland Gold Mining Co. discarded flotation and reverted to table concentration and cyanidation. More than 100,000 tons of dump ore assaying $2.25 a ton in gold and silver, both present as tellurides, had been dressed. The cause of failure of flotation, according to J. M. Tippett, mill superintendent for the Portland company, was that it was thought necessary to raise all of the mineral in the ore by flotation, and this in a water media. The result was that 20 to 30 per cent of the ore was put into concentrates low in value and still to be treated, and the residue was not at all satisfactory. The amount of gold in an ore is small, and after flotation any small quantity left in the residue is too valuable to lose.

Accordingly, application of flotation to gold and silver ores must be totally different to that for copper, lead, or zinc ores. Mr. Tippett is now trying flotation in this manner: First, float off a small amount that, so to say, "wants" to float, in cyanide solution, depressing the sulphides and making a rich concentrate containing less than 1 per cent of the ore. This small amount taken out by flotation happens to be the most difficult part to treat. This concentrate is given a special treatment, raw, and the tailings from the flotation machines are easily treated by the usual method in the cyanide plant, regardless of what the tailings may be after leaving the flotation machines.

In an article on "Flotation in Cyanide Solution" in the *Engineering and Mining Journal* for July 30, 1927, Mr. Tippett describes his patented process and gives a flow sheet of the Portland mill, together with the main features of the treatment.

Telluride Practice

According to *The Mines Handbook* for 1926, and the last two annual reports of the company, the Tomboy mine, at Telluride, Colo., which was recently closed and reported as sold, yields a gold-silver ore carrying lead, zinc, and copper. The sulphides amount to 2 or 3 per cent. During 1924-'25 and 1925-'26 the flotation plant dressed 205,436 and 211,668 tons, respectively, valued at $4.25 and $3.50 a ton. The bullion ratio to concentrates varied, but was about 25 : 75. Total expenses during these years were $3.07 and $3.15 a ton, of which milling was 55 to 58c. and concentrating 51 to 59c.

Treatment of Homestake Ore

It is of interest to note what A. J. Clark, metallurgist for the Homestake Mining Co., South Dakota, has to say concerning flotation in *The Black Hills Engineer* for May, 1926, where he reviews fifty years of metallurgy at that great gold mine:

> . . . It is also interesting to speculate as to what might have been had the flotation process antedated the cyanide process. Homestake gold floats fairly well; tests indicate that a recovery of 10 per cent or more in excess of that made by amalgamation could have been made.

Flotation in Canada

At Kirkland Lake, Ontario

In Vol. 73 (1926) of the *Transactions* of the A.I.M.E., W. A. Mueller, J. E. Grant, and C. L. Heath tell of the changes in the flowsheet at the Wright-Hargreaves mine, at Kirkland Lake, Ontario. Until 1925 the scheme of treatment which gave a high extraction was simply fine grinding in cyanide solution and filtration; but as the ore at the depth of 850 and 1,000 ft. carried tellurides, the extraction fell off. After experimentation it was decided to introduce flotation into the mill circuit. The overflow from the Dorr classifiers, which are in circuit with the tube mills, goes to a series of Callow flotation cells. Little oil is used. The concentrate, which assays up to $530 a ton, is roasted and the product is introduced into the regular grinding circuit and eventually cyanided.

Further information regarding the interesting situation that exists at Kirkland Lake is to the effect that flotation of the cyanide tailing was tried first at the Wright-Hargreaves and later at the Lake Shore and Teck Hughes. Flotation in a high-alkaline cyanide solution was not a success and it is now predicted that the solution of the problem will involve crushing and flotation in water to remove the refractory telluride minerals. Undoubtedly, unusually fine grinding of the ore will be required, even with flotation, because the gold is very finely disseminated in the ore. Three methods have been proposed for the treatment of the flotation concentrates: (1) Roasting followed by cyanidation; (2) decomposition with caustic soda and aluminum as at Nipissing, followed by cyanidation; or (3) leaching with bromo-cyanide.

Flotation in Africa

Treatment at Cam and Motor, Rhodesia

Most metallurgists will remember the difficulties that were met in obtaining a good extraction of gold from the Cam and Motor ore. This ore averages about 38s. ($9.12) a ton and contains antimony (1.19 per cent) and magnesia (4.32 per cent), with a little (0.51 per cent) arsenic. A plant embodying driers, Krupp ball mills, Edwards roaster, leaching tanks for sand, and vacuum filters for slime was put in commission in 1914, but up to 1919 it gave only 74 per cent extraction at a cost of 13s. 7d. ($3.26) a ton. A series of experiments that might result in improving the recovery of gold was started in 1920, according to D. V. Burnett in *The Mining Magazine* for February, 1926. A flow sheet shows that the overflow from ten vanners goes to six Dorr thickeners and then to the flotation plant. Approximately 12 per cent of the ore is removed by mechanical concentration and contains 73 per cent of the gold content of the ore. This concentrate assays 1.36 per cent antimony, 3.89 per cent magnesia, and 2.86 per cent arsenic, and is re-concentrated and amalgamated in a barrel with acid.

The concentrates from the vanners (after being re-concentrated) are dried and mixed with the concentrates from the flotation plant. The combined concentrates are then roasted. Flotation concentrates assay 7.80 per cent antimony, 2.51 per cent magnesia, and 4.09 per cent arsenic, 15.70 per cent sulphur, 14.60 per cent alumina, and 3.38 per cent lime. The loss in weight during roasting is 20 per cent and the extraction of gold by cyaniding the concentrates is 78 per cent. Total extraction of gold from the ore is not definitely stated, but it is about 85 per cent on a monthly basis of 21,000 tons. With reference to the flotation concentrate Mr. Burnett says:

> In consequence of the very finely divided nature of the flotation product and its physical and chemical composition, great difficulty has been experienced in dealing with it. The material flows through the roasters and causes foul roasting, coming out in a condition which allows of very little extraction of the rich gold contents taking place, and it is to this product that the attention of the company's metallurgist has been given for so long and which it is hoped will show that the difficulties have been overcome.

In commenting on an article in *The Mining and Industrial Magazine* of South Africa, early in 1926, in which are described the latest metallurgical practices in Rhodesia, the *Engineering and Mining Journal* for May 15, 1926, refers to flotation at the Cam and Motor and at the Sherwood Starr mines. The ore at the last-named mine contains a mixture of auriferous pyrrhotite and marcasite. About 90 per cent of the gold is removed by flotation, but the concentrate is not amenable to cyanidation, either with or without roasting, so is shipped to a smelter.

Witwatersrand Ore Presents Unusual Problem

H. H. Smith's "Flotation of Rand Pyritic Gold Ores," in the *Engineering and Mining Journal* for July 31 and Aug. 7, 1926, reviews present methods of extracting gold from banket. Some of the gold, he says, is incased in the pyrite. He describes the application of an all-flotation treatment to the pulp after the tube mills, and subsequent cyanidation of the concentrate, and the results of experiments made in a laboratory in London and in a plant on the Rand. Mr. Smith realizes the near approach to perfection [the average extraction of gold by amalgamation and cyanidation approximates 95 per cent] to which the technology of ore reduction and gold extraction has been brought on the Rand; hence, he concludes that further profitable reduction in tailing losses is most likely to be effected by innovations, and the tests and trials he describes show that flotation must be assigned a foremost position among any novel methods brought forward.

Against this conclusion may be placed the fact that in the third edition (1926) of "Text-Book of Rand Metallurgical Practice," by H. A. White and others, no mention is made of tests by flotation or of the possibilities thereof in treating banket.

Application of the Method in Australia

Experimentation at Kalgoorlie, Western Australia

Perhaps one of the most important series of flotation tests and discussions thereon is or has been under way at Kalgoorlie, Western Australia. Those engineers who have followed the trend of events at that once great but now steadily declining gold field know that the proposed means of reviving it are consolidation of the seven operating properties into one or two, with a central power plant and one or two treatment plants, and developments now point to that desirable consummation. I spent several years there and was fully conversant with the operations of the six dry- and five wet-treatment cyanidation plants. The daily tonnage of ore treated was then about 4,500; now it is about 1,800 tons in seven plants. Although there were certain disadvantages in the dry process, these were more than balanced by the advantage of treating only one product and the higher extraction of gold than by the wet process, at really little additional cost. Now the question arises, is flotation suitable for this sulpho-telluride ore and will it be the right process for any existing plants or for the proposed central plant?

Exhaustive laboratory and pilot-mill (1,500 lb. an hour) experiments on flotation have been in progress intermittently from 1923 until late in 1926 by A. S. Winter and B. H. Moore at the Kalgoorlie School of Mines and at the Oroya Links mine. Their results were published on pages 145-153 of the annual report of the State Department of Mines for 1925, in *Chemical Engineering and Mining Review* for Oct. 5, 1926, and in the *Australian Mining Standard* for Nov. 25 and Dec. 2 and 9, 1926. The gold is either free or associated with iron pyrite or tellurides, but most of the gold is with the pyrite, which constitutes 5 to 8 per cent of the ore. No direct process of cyanidation will extract this gold; the pyrite must be completely oxidized by roasting, either with all of the ore or as a concentrate. Eucalyptus oil and crude coal tar, and some kerosene, gave excellent results as flotation agents; and as a reagent the natural salt water from the mines is suitable; only the concentrate must be washed free of salt prior to roasting to prevent volatilization. A well-roasted concentrate gave the high extraction of 96.8 per cent of the gold by cyanidation. An eight-compartment M. S. machine of the sub-aëration type was used in the large-scale tests.

It is estimated that the flotation of 360 tons of ore daily would cost 2s. 5d. (58c.) a ton, and the total cost of treatment, including crushing and fine grinding, would be 7s. 4d. ($1.76) a ton, against an average cost of 18s. ($4.32) a ton for reduction and treatment at the seven mines of the district. In all, fifty-six tests were made on ore from four large mines, and Messrs. Winter and Moore conclude by stating that pyritic gold ores in Western Australia can be successfully treated at lower cost than by present processes, and, automatically, lower-grade ores could be mined and treated.

In *Chemical Engineering and Mining Review* for June 5, 1926, A. E. Paton, metallurgist at the South Kalgoorlie mine, discusses dry crushing and flotation at Kalgoorlie. Against the probable advantage of lower treatment costs resulting from flotation, Mr. Paton feels (1) that flotation is in the experimental stage as far as sulpho-telluride ores are concerned; (2) an increased extraction of gold could not be anticipated; (3) flotation is not applicable to oxide or semi-oxide ores; and (4) the change in plant involves large capital expenditure. A consolidation of the group of mines and a central treatment plant might make the flotation process profitable, but a comparatively small sum would put the dry-crushing plants in order, and to compete with the current average extraction of nearly 92 per cent, flotation has to be brought to a high state of perfection. Mr. Paton is not over-optimistic as to the future of flotation when the present condition of the mines is considered.

All of the reports on flotation at Kalgoorlie, including that of Kingsley Thomas, of Johannesburg, who critically investigated mining and metallurgical conditions there for the state government in 1925, were reviewed by H. W. Gartrell, of Adelaide, in *Chemical Engineering and Mining Review* for Oct. 5, 1926. He considers that Thomas wrote optimistically, Winter and Moore confidently, and Paton pessimistically. He supports Winter and Moore's conclusion that the introduction of flotation should enable lower-grade ore to be treated profitably, but does not think that they have submitted sufficient evidence to justify it, particularly as to the cost of the proposed plant. The great defect in Mr. Paton's paper is the paucity of that constructive criticism that he is so competent to give, and this has caused him to be regarded as unsympathetic toward flotation. Mr. Gartrell then attempts to reconcile the two sets of conclusions by inquiring whether inherent defects or advantages in the processes are likely to decrease or increase and whether the problem of milling may not have to conform to changed mining and management conditions. Kalgoorlie must be regarded as a field about to undergo drastic changes in which flotation will play an integral part. It is possible that the process as used on similar ores from the Portland mine, at Cripple Creek, Colo., and previously mentioned may suit Kalgoorlie ores.

Pilot Plant on Tests at Wiluna

In the re-development and re-equipment of the Wiluna mine, at Wiluna, Western Australia, a pilot flotation unit of fifty tons' capacity is now at work. Prior to its shutdown years ago, this mine produced 400,000 tons of ore, and recent drilling and exploration have revealed an equal quantity of about $10 ore, with good prospects of an additional several hundred thousand tons. It is proposed to erect a large ore-dressing and treatment plant; hence the pilot mill. The ore is lodestuff in quartz-dolerite greenstone, fine-grained greenstone (calc-schist), felsite, and porphyrite, and contains 50 per cent silica, 2.5 per cent mispickel, and 3 per cent iron pyrite, irregularly distributed in fine grains and sometimes crystals. The arsenic at Wiluna, as at several mines in Nevada, Montana, South Dakota, and British Columbia, is the troublesome element in the treatment of such ores.

New Use for Aluminum

It is said that the German Research Institute for Aluminum has discovered a special process which renders the metal suitable for use in the manufacture of food containers for fruits, vegetables, oil, and such things. German foodstuff makers are said to be already using this specially prepared aluminum, according to a writer in *Chemistry and Industry* (London).

Difficulties of Pumping at Veta Grande

By FRED W. RUTTENCUTTER
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AFTER the completion of the mill of the Veta Grande unit in 1919, water for operation was obtained by the Cia. Minera Asarco by running an incline sinking pump in the old Central shaft. This water was insufficient for operations on a larger scale and arrangements were made with the Alvarado Mining & Milling Co. to pump water from the Alfareña shaft on that company's property, about a mile from the mill. The amount of water necessary for mill and domestic purposes was about 250 g.p.m. In the latter part of 1922 water was encountered in the mines of this unit. On the 5½ level of the Sierra Plata, there were installed two Aldrich quintriplex pumps, having a normal capacity of 460 g.p.m. against a head of 690 ft. However, the development on this level did not produce water in excess of 800 g.p.m. This condition obtained throughout 1923.

At the beginning of 1923, the Veta Grande unit took over the operation of the Alvarado Mining & Milling Co.'s properties, and formed what is now called the Parral Consolidated. This deal included the Preseña group of mines, the Refugio, Cabadeña, San Juanico, and Palmilla. Development of each of these mines included the problem of first unwatering, and later installing suitable pumping units for the different levels involved. It so happened that this came at a time when a development program was planned for both mines of the Veta Grande unit. When the Alvarado was taken over, we inherited numerous old-style pumps in more or less bad condition. It was difficult to fit these pumps to the different conditions encountered, because of their head characteristics. The greater problem was to provide pumps of sufficient capacity to permit continuous development after the unwatering had been done. Our installations in this respect were planned more on guesswork than on any thing else, and our theory that water flow remains constant at any specified depth was disproved, as I will later show.

IN THE Alfareña mine we decided on an expected maximum flow of 1,500 g.p.m. for the 690-ft. total pumping head on the 8th level. Three old-style multistage pumps were installed, and for the 9th level, 164 ft. lower, two 500 g.p.m. centrifugal pumps were installed, and one 500-g.p.m. Goulds triplex pump. The two centrifugals on the 9th level pumped to the 8th, and the triplex pumped to the surface. Development of the 8th and 9th levels produced the maximum of 1,500 g.p.m. and benefited the Verde area to an extent that the Verde shaft was sunk to the 6th level (6th corresponds to 9th Alfareña), with the use of a small Cameron air pump, which pumped the small amount of water back into the vein on the 5th level. At this point, it will be well to note that all our working shafts are driven in the footwall.

DURING 1923 in the Refugio mine we reached a maximum of 2,000 g.p.m. while developing the 9th level. This level corresponds nearly to the 9th level Alfareña and 6th level Verde. For this work was used a 2,000 g.p.m. sinking unit, suspended in the shaft, and a 1,500 g.p.m. station unit (centrifugal) pumping against a total head of 500 ft. Later this capacity was augmented by stage pumping from the 9th level to the 6th level, using two old pumps designed for 1,100 g.p.m. at 375 ft. head. With this arrangement it was possible to pull the sinking unit and keep it in reserve for recovery of the mine if it should be flooded on account of failure of power or equipment. Failure from both causes occurred frequently; at one time there were only 12 minutes' leeway before water would enter the motor windings.

In the Palmilla mine a 1,500-g.p.m. deep-well centrifugal pump, operating against a 250-ft. head, was installed. Water from this mine was used primarily for milling purposes at the Palmilla mill until work was started in the mines. However, no additional equipment was necessary to unwater the mine completely. The next step was to unwater the Verde, Sierra Plata, Cabadeña, and San Juanico. For the Verde, the same assumption was made as for the Alfareña—namely 1,500 g.p.m. which was proven wrong, and eventually we had to install pumps of a capacity of 4,000 g.p.m., or eight units of 500 g.p.m. each against a total head of 817 ft. In the Sierra Plata the 1,500 g.p.m. guess was correct. However, in the case of that installation a 500-g.p.m. centrifugal was installed on the 5½ level with the two quintriplex pumps already mentioned and on the 6th level three 500-g.p.m. centrifugal units at a 155 ft. head, pumping to the 5½ level.

For the Cabadeña mines we had old equipment from the Alfareña mine, which had closed down meanwhile, and for recovery purposes the 2,000-gal. sinking pump from Refugio. The maximum amount of water encountered in this mine was approximately 1,200 g.p.m., the total head being 325 ft.

In San Juanico the unwatering problem was comparatively simple. The 2,000-g.p.m. sinking pump unit was used for recovery, and two single-stage centrifugal units were fashioned in the shops. Stage pumping was resorted to. In this case, one pump was installed on the second level which pumped directly into the suction of the pump installed on the first level, and this pump sent the water to the surface. The total head was about 250

ft., divided equally between the pumps. Shaft sinking was in progress at the Sierra Plata, Verde, Cabadeña, and Santa Ana during 1925 and 1926. Our records led to the belief that we would have increased the amount of water to handle upon opening the level to the vein, approximately as follows: For Sierra Plata, 1,500 g.p.m.; Verde, 4,000; Santa Ana, 2,000; Cabadeña 2,000; total 9,500 g.p.m.

INSTALLATIONS of pumps were made in accordance with the plan, except in the Sierra Plata development, which has been held up until recently. An interesting feature of mine drainage is the question of how much water will be encountered upon opening up the lower levels. We have always believed that lower levels would produce more water. This was not proved true in the mines of this district. It is true that for a period of time more water will be handled, but only until the drainage of the vein between levels is effected. This takes a long time and is dependent upon the advance in mining. In 1923 the lowest depth at which mining was carried on corresponded to the 5th level Verde. The maximum amount of water handled was approximately 5,400 g.p.m.

In 1924 the lowest depth corresponded to the 6th level Verde, the maximum amount of water handled being 6,000 g.p.m. In 1925 the lowest level was the same and the maximum amount of water handled was 5,400 g.p.m. In 1926, the lowest level being the same, the water handled was 5,100 g.p.m. The year 1927 saw the opening of the 7th level Verde, the Santa Ana 10th, and the Cabadeña 5th, all at about the same time. The maximum amount of water reached was in April of this year and was 7,900 g.p.m. This has dropped and the maximum on June 1 last was 6,100 g.p.m. As can be seen, the opening up of a lower level about 164 ft. further down meant the handling of an excess of water for a short period of time only, and the normal flow remained as of the level above.

The history of pumping at this unit of the American Smelting & Refining Co. being told, little remains that would be of interest. To recite all our griefs in maintaining equipment for shaft sinking and operation would take a great deal of time. Some things I will point out as outsanding in importance. Among them the causes of pump failure.

SOME of our mines record very little leeway in power interruptions and pump failures. When power goes off or pumps fail, miners must be called from the workings. This is usually accomplished by shutting off the air from the machines, and by means of other alarms. Bulkhead doors next are closed. Then it is a matter of waiting for resumption of power service or of repairing pumps quickly, as the case may be. Repairs as a rule are easy to make, for we keep wearing parts on hand at all times. The problem is to know what has to be done. As for that question, I will give some causes of pump failures, and the reader who is interested may take his pick of what has happened at the time of failures.

The following causes of pump failure relate to installations that have been operating and are not just starting for the first time:

No. 1. No water delivered.

(a) Priming. Pump and suction not completely filled.

(b) Speed too low.

(c) Suction lift too high (over 15 ft).

(d) Impeller completely plugged.

No. 2. Not enough water delivered.

(a) Air leaks in suction or stuffing boxes.

(b) Impeller plugged.

(c) Mechanical defects such as wearing rings worn, impeller damaged, casing packing defective, foot valve obstructed.

No. 3. Not enough pressure.

(a) Speed too low.

(b) Air in water.

(c) Mechanical defects same as in No. 2.

No. 4. Pump works for a while and then quits.

(a) Leaky suction line.

(b) Water seal plugged.

(c) Suction lift too high.

(d) Air in water.

(e) Suction piping and valves not completely freed of air when priming.

My usual routine work is inspection and permanent maintenance. With the class of workmen that we have here, a visit to our various pumping stations is a daily necessity; also it effects a great saving in power and lubricants. I find that the pump men are prone to operate too many pumps so as to give them more opportunity to cat-nap on the job, for thus they can keep the sumps pumped low, so that if one pump is not doing its full duty, the other pumps can carry on while they sleep. We regulate the discharge with the discharge valve. Also we have made a big saving in lubricating oil by draining the old oil from the bearings and filtering it. A decrease in consumption of from 10 gal. a day to 3 gal. was effected. By periodic shutting down of one or more pumps and letting the sumps fill, a greater saving in power was made. We showed a daily saving of $24 in the Verde and in the case of the Santa Ana $13 per day. This is a good argument in favor of automatic pumping. However, that is a matter for future study.

California Is a Large Producer of Diatomite

According to V. L. Eardley Wilmot, writing in Vol. 35 of *The Mineral Industry,* diatomite (diatomaceous earth, kieselguhr) is found in many countries, but, the largest known deposits are in California, where the mineral occurs in compact beds in many places 1,000 ft. thick. The majority of the West Coast deposits are of marine origin, whereas some of those in Nevada and Oregon, as well as all those in eastern Connecticut, New Hampshire, and New York, were formed in fresh water. The last-named occur as comparatively thin beds on lake bottoms.

Diatomite is used to a very small extent as an abrasive in the form of metal and some automobile polishes, in finger-nail polishes, and in some dental powders. The bulk is, however, used for filtering, heat insulation, and fillers. For the majority of its uses diatomite must first be calcined to burn off carbonaceous matter, and then pulverized, cleaned, and graded by cyclone and other air separators.

DISCUSSION

When Doctors Disagree

THE EDITOR:

Sir—Who shall decide, when doctors disagree? The disagreement of doctors which I have in mind is that between different schools of geologists regarding the interpretation of mineral sequence from evidence afforded by thin and polished sections. Because of the mere fact of disagreement it is evident that some of the interpretations are based on mistaken criteria, whether attributable to following of certain time-honored opinions or to false analogies drawn from metallurgy. The whole question of evidence of sequence is due for an overhauling, and we must constantly be on our guard to prevent criteria not thoroughly proved from creeping into the literature. All this by way of apology for questioning certain minor points in Dr. Schwartz's[1] excellent paper.

In the first place, regarding not so much the author's statement: "Euhedral crystals in a gangue lacking evidence of other relationship are probably contemporaneous," as numerous conclusions in geologic literature based on the same principle, I wish to point out that *lack of evidence of sequence is not proof of contemporaneity.* As he truly says "Evidences of contemporaneity are not abundant."

The problem of inclusions of chalcopyrite in sphalerite and *vice versa* is very puzzling and has never been satisfactorily solved. Though the skeleton crystals of sphalerite described by Emmons and Laney[2] are found in veins where sphalerite is rare, similar crystals have been described by R. P. Koeing[3] from the pegmatite of Ivigtut, Greenland, in specimens which I have had the opportunity of studying. Here, as was not the case at Ducktown, there is no lack of sphalerite in the field. Large areas of sphalerite and chalcopyrite adjoin each other. Within the sphalerite are abundant dots of chalcopyrite, in the "emulsion" texture so common, especially in the black sphalerites of high-temperature ores. Just across the boundary, within the main area of chalcopyrite, are star-like skeletal crystals of sphalerite.

The "emulsion" texture has been shown quite convincingly by W. H. Newhouse[4] to be, in some cases at least, a result of replacement of sphalerite by chalcopyrite. Skeletal crystals of sphalerite in chalcopyrite have been described by W. B. Jewell[5] from the Hyder district, Alaska, and are interpreted by him as "remnants of sphalerite which have been replaced differentially along the cleavage by chalcopyrite."

On the other hand, dendritic crystals of certain substances are in some cases undoubtedly introduced later than the inclosing material, as, for example, the crystals formed in gels described by Fisher before the Mineralogical Society of America in 1925.

In the light of the above, may I ask Dr. Schwartz why "it may be safely concluded that sphalerite and chalcopyrite with this relation are contemporaneous" when in the Ivigtut material the adjoining mass of sphalerite contains chalcopyrite in "emulsion" texture—a texture in which quite commonly the chalcopyrite follows crystallographic directions and grain boundaries in the sphalerite?

As for the Ducktown ore "certainly not" being deposited from a melt, probably Mr. Spurr would not agree, but I question only the word "certainly."

The last sentence in the article is puzzling:

". . . the crystals described [presumably magnetite] did not grow in a melt. If it [they?] did, a sinter would not result" whereas in the first part of the article: "Examination shows that part of the mass has recrystallized and part seems to have crystallized from a local molten area, as it is probable that at least a small area surrounding a center of combustion becomes molten."

I would infer that some of the magnetite crystals grew in miniature melts (a melt is a melt, however small). But granted that they did not, how can they be contemporaneous with the inclosing material? Or at least how can we know that they are?

Possibly the author's point is that because the whole process of sintering took only forty minutes, all the crystals that formed during the process were contemporaneous. If so, my contention is that if there is a difference of ten minutes between two crystals, we are not justified in concluding that the texture would be any different were the lapse of time ten years. But perhaps I am setting up a straw man.

My only argument is that the author has not proved contemporaneity with the inclosing material either for his magnetite crystals or his sphalerite crystals and that the criterion in the case of the sphalerite is still open to question. Probably this is because he did not take (or perhaps was not given) sufficient space to state his case clearly. My plea is for information.

El Paso, Tex. HUGH E. MCKINSTRY.

* * * *

Antiquity of Africa's Copper Mines

THE EDITOR:

Sir—In connection with the discussion in your paper concerning the antiquity of the native copper mines in Africa, a bit of evidence came to my notice which tends to show a considerable age in one working. It is not at all conclusive but is interesting, to me at least.

I recently saw a stone chisel and a stone hammer which were found in ant hills (termite nests) by boys clearing for a transmission line and road near the Kipushi mine, on the Congo-Rhodesia border. The chisel was five

[1] "Magnetite Crystals in Sinters—The Sequence of Mineralization." *E. & M. J.*, Vol. 124, pp. 453-454, 1927.

[2] "Geology and Ore Deposits of the Ducktown Mining District." U. S. Geol. Survey, Professional Paper 139, 1926.

[3] Unpublished report, Laboratory of Economic Geology, Harvard University, 1925.

[4] *Econ. Geol.* Vol 21, p. 68, 1925.

[5] *Econ. Geol.* Vol. 22, p. 503, 504, 1927.

meters below the surface of the hill. The hammer was in another hill and not quite so far below the surface.

It is quite likely that these were used in breaking out the ore from the near-by mine. I do not know of reliable estimates of the age of these ant hills. I am inclined to think that those of equal size may vary considerably in age, being built upon and then lying quiescent for years, according to the amount of rainfall and other things, affecting the termites.

I have in mind one ant hill near the top of a rounded, rocky knoll at Panda. At a height of three feet from the surrounding ground-level, pieces of stone the size of an egg are imbedded in the clay of the ant hill. As the termites could not have raised the bits of stone, the knoll must have weathered away to the depth of three feet since the ant hill was started. Perhaps some geologist will venture a guess as to the time required for a rounded knoll of hard shale to be cut down that distance by the elements.

My guess is that the average ant hill five meters high and ten to fifteen meters in diameter at the base is not less than 1,000 years old. Estimating their age from their cubical contents is likely to be quite inaccurate. One apparently young ant hill which I noticed particularly six years ago seems to have added not more than a quarter of a cubic meter in that time. On the other hand, I have seen many which, from their looks, have lain unchanged for ten or twenty years and then have had a fresh start in which a quarter of a cubic meter has been added in a single year. Some of these ant hills contain 500 to 1,000 cubic meters.

My impression from the above and from the wide distribution of the native workings is that the latter go back 1,000 years or more. S. WARD HAAS.

Panda, Katanga, Belgian Congo.

* * * *

Gangue and Water Must Be Considered in Flotation Tests

THE EDITOR:

Sir—I have read with interest the discussions in recent issues of the *Engineering and Mining Journal* on flotation reagents, particularly the data relating to the effect of conditioning reagents by Messrs. Parsons and Johnson. Mr. Johnson discusses the particular ore which he is treating, whereas Mr. Parsons speaks of more general conditions. Although I think there are general rules to follow in selecting reagents for sulphide ore, nevertheless much experimentation is needed in applying general principles to specific ores. In my opinion the dissimilar effects of reagents are to be attributed largely to the natural chemical conditions of the pulp, and special attention should be paid to the gangue material and water. In many ores the reagents used to condition or increase the floatability of minerals also make the gangue more easily floated, whereas on other ores of apparently similar type the effect on the gangue may be entirely different. It is therefore evident that conditioning of this gangue material is of as much importance as treating the mineral for increased or decreased floatability. My first effort in treating a new ore is to analyze the gangue and test the water to be used; it is then easier to select reagents for trial, and the first results will be more encouraging. R. W. LOYD,

Mill Superintendent, Pend Oreille Lead & Zinc Co.
Metaline Falls, Wash.

Australian Gold Fields

THE EDITOR:

Sir—Australia is the latest of the world's large areas to be settled by the white man and is still in its infancy as regards population and development. The State of West Australia, occupying one-third of the total area, is even less advanced in these respects than the other Australian states. The potentialities of all the states for the future are great, but the facts regarding West Australia appear to be little known, as exemplified by the editorial in the Dec. 11, 1926, issue of *Engineering and Mining Journal*. Particularly does this seem the case with regard to the northern part, to which special reference is made therein.

A misunderstanding has arisen as to the attitude of government officials to certain areas. The Murchisons, Coolgardie, Kalgoorlie, and Dundas fields are not regarded as liabilities rather than assets. This impression is no doubt the result of the recent case put before the commonwealth by the state, in which the disabilities caused by the latter through the federal connection were set forth, and in which relief, or compensation, for those disabilities was sought.

To make the position clear, certain factors covering the period since federation, in 1901, must be outlined. The state was far from overwhelmingly favorable to entering the federation. It entered only because of the large population, most of whom, at that time, were recent arrivals from the eastern states, and between whom and the native westerners there existed much bad feeling. The latter as a whole resisted the action, fearing exploitation of the state by the more populous and wealthy states. Those fears have been more than justified, and the federal connection has proved a great and increasing burden on the state.

The report of a Royal Commission, appointed in 1925 to investigate the issue, stated that the state had not been, and still was not, ripe for federation. It recommended that it be relieved from customs duties for twenty-five years and, pending such relief, be paid £450,000 yearly. This sum represents about the average of the annual deficit for some years. The commonwealth then proposed to allow the state £300,000 annually for an undefined period and to take over that part of the state north of latitude 26 deg. That part of the offer providing for a diversion of territory the state refused. The question of its handing over the territory north of latitude 20 deg.—virtually the Kimberleys—is still, however, under consideration. Much may be said in favor of the transfer, the climatic and general economic circumstances of the area coupling it more naturally with the Northern Territory than with the rest of West Australia, from which it is separated by a belt of, at present, practically worthless country.

It is probably the above-mentioned £450,000 that is referred to in the editorial, as the sum of which the commonwealth would relieve the state yearly by taking over the north. It might be noted too that the fields mentioned in the editorial, except Kimberley, are south of latitude 26 deg. No question of their being detached from the state has been raised, or is likely to be. Nor would the state or the residents consider such a proposal.

Readers of *Engineering and Mining Journal* are especially interested in mining. West Australia is well endowed with mineral deposits containing proportions of metals and commercial minerals that in most localities

would make them profitable, especially gold and copper. The quantity of gold contained in such deposits is great. Costs of production, however, are high, owing to the high cost of material and of living caused by the present national fiscal policy; to the fact that most of the deposits are long distances from the coast; to the sparseness of the population, which means high transport costs to ports; in many cases to the absence of local fuel and mining timber; and in some cases to lack of sufficient water.

To these adverse factors must be added the absence of local capital. The state, being young and lacking population, obviously can possess little accumulated capital. Even in the eastern Australian states, capital is meager relatively to that in the United States and Britain, and for some years past the bulk of that capital has favored investment in manufacturing and neglected mining. Thus deposits and mining fields that, even with the above local natural conditions, would be exploited in the United States stand neglected in West Australia.

Perth, West Australia. W. W. SLEEMAN.

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The Mexican Can Be Led

THE EDITOR:

Sir—Although, in general, Mexicans have primitive instincts and, for that reason, are savage, cruel, and dangerous when aroused, it must not be forgotten that they are also human, and as amenable to an appeal to better judgment as any people in the world, and more so than a good many.

It is possible that your editorial, "Bandits Here and There," on the front page of the *Engineering and Mining Journal* of Sept. 3, 1927, might give a wrong impression of the Mexican character.

As a proof that the Mexican can be led far better than he can be driven we have the policy followed in that isolated locality at the boundary of Durango and Sinaloa. Here the Mexican Candelaria Co. has operated for many years at San Dimas, Durango, and Contra Estaca, Sinaloa. The San Luis Mining Co. is developing a wonderful mine, paying big dividends, at Tayoltita, Durango, and the Nueva Compañia de San Vicente has an excellent property which is situated at San Vicente, Sinaloa.

Some forty-odd years ago the beloved Colonel Dan Burns, known as Don Daniel to every inhabitant for miles around, from the Pacific Ocean to the crest of the Sierra Madre, pioneered into that country and reopened the old and forgotten mines of the district. His diplomacy in getting along with the people has been followed by other real men, of the type of Field, Swent, Goetter, Furry, and Dr. Kirschner, with gratifying results. Federal troops have very rarely been closer than San Ignacio, 35 miles away; and the nearest real garrison of consequence is at Mazatlan.

The entire neighborhood has always been orderly except for some minor flurries. Even during the wildest days of the revolution, none of the above-named companies were compelled to stop a wheel. The business continued as usual. In bullion shipments, that have gone well into millions, the loss of only one bar was reported; and that was because one of the mules slipped on a boulder and drowned when crossing a swollen stream. The animal carried two bars. Only one was recovered, because the torrent carried the other away.

Zacualpan, Mexico. A. R. SCHLOESSER.

By the Way

Shoots and Chutes

A REPORT of the Rhodesia Minerals Concession, Ltd., to its shareholders states that "Matala has indicated strike of about 3 miles and several ore chutes of payable length will be developed along this strike." We suggest that something more is needed besides ore chutes: shoots of ore must be developed to fill them. This, after all, is no doubt what Mr. P. K. Horner meant when he imparted this bit of information to his company. We are inclined to think his report suffered from some unintelligent editing before it appeared in print.

* * * *

What Are the "Porphyries"?

"THE Kennecott system, taken as a whole, represents the world's premier porphyry mining enterprise," says The Mines Handbook Weekly Copper Survey. "Speaking of porphyries, the writer was considerably amused the other day by seeing a definition of porphyry mines, made by the statistician of a stock exchange house, as being those in which the ore had been proved up on two sides. Undoubtedly there is considerable misunderstanding of the term 'porphyry.' Properly speaking, 'porphyry' is any igneous rock showing distinct isolated crystals in a dense or crystalline matrix. Porphyry may be granite, quartz, or one of several other rocks. The term 'porphyry,' therefore, is applied to the formation rather than to the method of indicating proved ore. As a matter of fact, the reason that certain copper companies are termed porphyries is that the copper in the two beginners, Utah Copper and Nevada, is disseminated in porphyry rock. Although it happens that the copper-bearing formations mined by Ray, Miami, Inspiration, Chile, Braden and New Cornelia differ somewhat, the dissemination is similar enough, so that these also are included under the generalization 'porphyry coppers.'"

* * * *

It May Be a Gold Mine at That

OUR esteemed contemporary, *The Wall Street Journal,* is authority for the following story:

A broker who has a number of discretionary accounts which he has been successful in running has a client who trusts in him implicitly, but in turning over his account to the broker he particularly desired that there should be no trading in mining stocks. Evidently he had had troubles in that direction, for his antipathy toward this variety of stock was most pronounced. The broker, thoroughly convinced, kept well away from mining shares for this account and so was very mystified when he received a letter from the client asking him why he had broken his promises in regard to trading, and mentioning the date the alleged mining stock had been bought. On looking over the books the broker discovered that the only purchase he had made for his bachelor friend that day was 500 shares of Gold Dust.

It may have been a gold mine, at that, for if we remember correctly, and we do, there is a gold mine by that name out in the Oatman district of Arizona which would no doubt be pleased to sell 500 shares to anyone. Gold Dust may be a gold mine in the more colloquial sense of that term also, for there must be a vast amount of money in buying tri-sodium phosphate, borax, and similar well-known detergents by the carload, and selling them as small packages of mysterious washing powder for 10 and 25c.

NEWS OF THE WEEK

Summary

SENATOR ODDIE serves notice that responsibility for the withholding of reasonable appropriations for the discharge of the government's obligations to the mineral industry is going to be fixed precisely.

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J. F. Robinson, president of the Tri-State Zinc and Lead Ore Producers' Association, declares at annual meeting of the Association that present unsatisfactory condition in the district is largely the result of failure in the past of the mining men to co-operate.

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Consolidated Mining & Smelting Co. of Canada is soon to begin active mining operations at the Old Sport mine on Quatsino Sound, Vancouver Island.

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Hercules Mining Co. of Wallace, Idaho, ships zinc concentrates to Bartlesville, Okla., when unable to dispose of them in the Coeur d'Alene district.

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Closing of small mining properties continues in Mexico. In most cases closure is solely the result of low metal prices and high transportation costs.

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Premier Gold Mining Co. acquires 76 per cent control of the Prosperity group in the Marmot River section of British Columbia.

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Noranda Mines makes the third important surface discovery of the year on its property in the Rouyn district of Quebec.

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Worthington mine of the Mond Nickel Co. near Sudbury, which caved in on Oct. 3, will be abandoned.

Main building of Sullivan zinc plant under construction

Sullivan Mining Co. Rushes Zinc-Plant Construction at Kellogg

Present Progress Indicates That Production of High-Grade Zinc at a Daily Rate of 50 Tons Will Begin April 1, 1928

PROGRESS in the erection of the new electrolytic zinc plant at Kellogg, Idaho, by the Sullivan Mining Co. indicates that the plant will be turning out high-grade zinc at the rate of 50 tons per day about April 1, 1928. The plant, which involves an expenditure of about $1,250,000, was scheduled for completion a few months earlier, but the engineers who designed it preferred to go more slowly and be sure that no radical changes in the mechanical features would be necessary after operations were begun. For that reason some delay developed. U. C. Tainton, consulting metallurgist, is chiefly responsible for the design. Assisting him is Wallace Woolf, research metallurgist for the company; and in charge of construction is Walter K. Mallette, who is well known for his work in connection with plant construction in various mining districts in the United States and Mexico.

The principal source of concentrate for the plant is the ore of the Sullivan mine, owned jointly by the Bunker Hill & Sullivan and Hecla mining companies. The mine will be worked through the Hecla shaft, and the ore will be milled in the "South" concentrator, one of the group of plants on the Bunker Hill ground. Selective flotation will be used to make a lead concentrate for shipment to the Bunker Hill smelter, and a zinc concentrate for treatment in the new zinc plant.

The process differs from that used at Trail by the Consolidated Mining & Smelting Co., and at Great Falls, by the Anaconda company, in that there is a single leaching circuit, instead of a combination of acid and neutral circuits, and in using leaching solutions of higher acid strength, and higher current densities in the electrolytic department. Wedge roasters, modified slightly from the standard design, will be used. The calcine is to be divided in Dings magnetic separators into two portions, one being comparatively free of ferrites and the other containing nearly all of them. A novelty of the process is this separation, by means of which it is possible to start a leach charge with calcine containing ferrites and finish it with calcine of the second class. As a consequence the ferrites can be effectively attacked with the strong acid at the beginning of a cycle, whereas the less

refractory portions of the calcine can be used to finish the cycle when the acid has lost much of its strength and leaching action.

Agitation will be by mechanical means instead of with airlifts, and Burt pressure filters will be used for recovering the zinc-bearing liquor. Fumes from the roasters will be passed through a Cottrell treater before entering the 250-ft. brick stack that is now nearing completion.

Although the rated capacity of the unit now being built is 50 tons of zinc per day, plans call for the installation of equipment to bring the capacity up to 100 tons immediately after the present unit is in operation. In fact, parts of the present installation are designed for the larger tonnage. Ultimately, custom concentrates will be accepted and arrangements may be made to concentrate complex ores on a custom basis.

The accompanying photograph shows the progress made up to September, 1927, on the main building housing the roasters, the magnetic separators, the leaching department, and the filters.

Ship Coeur d'Alene Zinc Concentrates to Bartlesville

THE Hercules Mining Co., of Wallace, Idaho, which operates a custom mill for lead-zinc ores, recently started shipment of zinc concentrate to a reduction plant at Bartlesville, Okla. This is the first shipment of zinc from the Coeur d'Alene district to a Mississippi Valley zinc plant in several years, the high freight tariff incident to the long haul being a barrier to profitable shipments at the prevailing price of zinc. This condition operated in favor of the Anaconda electrolytic zinc plant at Great Falls, but which is now unable to take all the zinc offered from the Coeur d'Alene district, on account of the large shipments of zinc from Anaconda's own sources of supply. Thus, when a few months ago the Hercules company entered the field as a buyer of custom lead-zinc ores, it was unable to find a buyer for its zinc concentrate, with the result that there was a large accumulation of that product on hand. Evidently the company has finally found a buyer at Bartlesville, and, if shipments continue, it naturally follows that Hercules has probably obtained more favorable freight and treatment rates than has heretofore been obtained by operators in the district.

Park King Company Begins Deep Development

Deep development is to be started at the Park King Mining Co.'s property, adjoining the Park-Utah mine at Park City, Utah. A power line has been completed, and a compressor and electrical hoist are being installed. A strong fissure, believed to be the eastern projection of the Park Utah fissure, is to be prospected in the quartzite by sinking a winze at a point 300 ft. from the mouth of the tunnel.

Mond Nickel Co. to Close Worthington Mine

THE CAVE-IN which occurred at the Worthington mine of the Mond Nickel Co. near Sudbury on Oct. 3 will necessitate the abandonment of the property. The apparent cause of the trouble was a fault, the existence of which had not been suspected. A slight subsidence took place, weakening the pillars and allowing the whole upper part of the mine to collapse. The surface depression which resulted from the cave-in is approximately 800 ft. in diameter. A number of buildings, including the power plant and about 200 yd. of the Canadian Pacific Railway tracks, were engulfed. Fortunately there were preliminary movements before the cave-in occurred; these permitted all the miners to be withdrawn and prevented any casualties. A miner and his wife and child, however, had a narrow escape while in a house which slid down the side of the opening for a distance of about 40 ft. The house remained in an upright position and no one was injured.

The mine has been worked for a number of years, and a depth of 1,500 ft. had been reached. It is understood that the company had planned to suspend operations at the property within a comparatively short time, so no attempt, therefore, will be made to reopen the mine.

Tri-State Producers' Association Holds Meeting

J. F. Robinson, President, Blames Mining Men for Present Unsatisfactory Conditions in District

THE annual meeting of the Tri-State Zinc and Lead Ore Producers' Association was held at Picher, Okla., on Oct. 3, and was well attended by mine operators and general business men of the district. Thirteen directors were elected, and two more are to be selected later from new members. The directors will meet soon and select officers. It is expected that C. F. Dike, of Joplin, head of the Oklahoma Woodchuck Mining Co., will ultimately become president, although J. F. Robinson, of Miami, may be the temporary choice. Directors elected were: Frank Childress, P. B. Butler, F. H. Kissling, T. F. Lennan and C. F. Dike, of Joplin; S. H. Davis, of Baxter Springs, Kan.; W. T. Landrum and George Provine, of Picher, Okla.; and J. F. Robinson, Charles Neal, George Pearson, M. F. Owens, and C. Y. Semple, of Miami, Okla.

Some of the accomplishments of the organization were recited by J. D. Conover, secretary. J. F. Robinson, president, declared that even if the association cost as much as 50c. a ton, which is far above its actual cost, it would be well worth while; the district could not afford to get along without it under any circumstances. He declared the present unsatisfactory condition in the district is attributable largely to failure of complete co-operation of mining men in the past. R. V. Ageton, safety engineer, reported the improved conditions as to percentage of accidents in the field, and Dr. F. V. Meriwether, director of the Tri-State clinic, stated that more than 7,000 workmen of the field have been given a thorough physical examination since the clinic was started. An interesting feature of the meeting was the report of the treasurer, George Pearson, who announced that the association has more than $40,000 on deposit in the various banks of the district. During the last year alone, receipts have exceeded expenditures by $9,000. A resolution was introduced, and passed, protesting against initiative petition 101 in Oklahoma, which would increase the gross production tax in that state 200 per cent on minerals.

The Century Zinc Co. is opening up a new mine in the Joplin-Miami district showing an unusually large orebody. It is known as the Campbell mine, and the ore run has been blocked out through three forty-acre tracts, all of which the Century company has under lease. Four shafts have been completed into the orebody, which bottoms at 175 ft. on the west end of the lease and at 155 ft. on the east end. It has an apparent width of from 100 to 200 ft. Engineers of the company believe it is the same run mined at its Malsbury mine, which has been an unusually rich property, recovery running as high as 20 per cent. The new mill that has been completed at the Campbell tract is one of the most modern in the district, and includes several improvements outlined by C. O. Anderson, former metallurgist for the U. S. Bureau of Mines, who is now with the Century company.

A new mill is being built by the Allie Moore Mining Co., on the Allie Moore land at Crestline, Kan., in the Joplin-Miami field. It will be in operation within a few weeks, according to Leonard Goings, manager. It is the second new mill to be erected in the Crestline section in the last few months, the Crestline P. & S. Co. having recently completed a mill on the Ellis land.

Damage Suit Filed Against Hydraulic Mines

A $27,000 damage suit has been filed by the U. S. district attorney of San Francisco against the South Yuba Mining and Development Co. and the Globe Indemnity Co. The government contends that on Feb. 19, 1927, the company's dam failed and released some 220,000 cu.yd. of débris into the Yuba River. Expenditure of $22,000 will be necessary to clear the Yuba. The South Yuba was incorporated to take over the property of the Omega Placer Mining Co. in the Washington mining district.

Budget Officials Informed of Public Opinion in Western Districts

Senator Oddie Serves Notice Responsibility for Withholding Reasonable Appropriations Will Be Fixed—Confers With Secretary Hoover

By Paul Wooton
Special Washington Correspondent

BUDGET OFFICIALS in Washington have a new conception of public sentiment in the West in regard to its attitude toward the mining industry. Senator Oddie, of Nevada, the chairman of the Committee on Mines and Mining of the Senate, has returned to Washington fresh from contact with mine operators in several sections of the West. He has served notice that responsibility for the withholding of reasonable appropriations for the discharge of the government's obligations to a great basic industry is going to be fixed precisely. Everette L. DeGolyer, president of the American Institute of Mining and Metallurgical Engineers, recently conferred at length with officials at the Budget Bureau.

Department's Attitude on Increases

As the hearing before the Mines and Mining Committee last year developed the fact that the Budget officials of the Department of Commerce had been responsible for a material amount of the reduction which had been made in the requests of the Bureau of Mines for funds, Senator Oddie, immediately on his return to Washington, conferred with Secretary Hoover as to the attitude of the department toward increases in the budget which will be submitted to Congress in December. He found that Secretary Hoover is in full accord with the demand of the mining industry that its appropriations be brought more nearly in proportion with those received by agriculture. Secretary Hoover told Senator Oddie of his deep desire to develop comprehensive economic research work in the Bureau of Mines and at the same time augment as much as possible the technical research work in that Bureau. Senator Oddie told the Secretary that the Mines and Mining Committee hearing at the last session had revealed the fact that Secretary Hoover's own budget officers had not grasped the Secretary's desires in that regard. He called upon Mr. Hoover to make sure that Assistant Secretary Drake and his staff are acquainted with his desires in that regard.

Senator Oddie expressed regret that Secretary Hoover had been criticized personally for the action of the department in slashing the requests of the Director of the Bureau of Mines. He stated, however, that the mining industry understands clearly that it has a champion in Secretary Hoover and that it is realized that he cannot handle personally all details of a great department which is doing more than $30,000,000 worth of public work each year. To explain that point, Senator Oddie called attention to a letter written by Francis A. Thomson, dean of the Idaho School of Mines, to Secretary Hoover, explaining the phrases in the resolution which might be regarded as uncomplimentary to him. In that letter Dean Thomson, among other things, said: "I trust you will not feel that the committee has been actuated by any other motives than those of service to the mining industry and that whatever implied criticism of yourself is embodied in the resolution is based upon the most adequate information obtainable. I feel sure that the final result of the campaign which the Columbia Section is initiating will be to strengthen your hands in giving to the Bureau of Mines the financial support which you, better than anyone else in the country, know it needs and deserves."

When the resolution came to the attention of Assistant Secretary Drake he wrote Dean Thomson criticizing its language. "It seems unnecessary," says Secretary Drake's letter, "to comment on the attitude of Secretary Hoover toward the mining industry and his many efforts to make the services of the Bureau of Mines and other activities of this department most responsive and valuable to the needs of the industry. It is regrettable that the resolution should voice criticisms that are evidently based upon meager information and lack of knowledge of the situation of the department with reference to appropriations." This led Dean Thomson to reply to Mr. Drake, stating that "I yield to no one in my respect and admiration for Mr. Hoover, but my support of that portion of the Columbia Section resolution to which you take exception was based quite largely upon the information elicited by Senator Oddie during the hearing before the Mines and Mining Committee, at which you were present. Possibly, my dear sir, the criticism of Mr. Hoover to which you take exception should actually have been directed at your good self, but, of course, in public matters of this kind the chief must stand for the actions of his lieutenants."

Internal Allocations of Funds

At the Bureau of the Budget it was explained that though a grand total had been fixed for the Department of Commerce which, it is hoped, will not have to be exceeded, it is the practice of departments to make their internal allocations in much the manner which they wish, so that it is entirely possible for it to withhold funds from less essential activities and allot them to those services for which there is acute need.

The Bureau of the Budget, however, does its pruning after the estimate leaves the executive department and before it is sent to Congress. The hope is expressed that Mr. DeGolyer's representations will have the effect of preventing any such action in connection with funds which may be allotted to the Bureau of Mines.

Senator Oddie announced on Oct. 7 that a meeting of the Mines and Mining Committee would be called at the earliest practical date after the convening of Congress on Dec. 5, to discuss the general question of government research on mining subjects. In that connection it may be stated that there is the keenest interest in the matter on Capitol Hill. It happens that half of the members of the Senate Committee on Mines and Mining come up for re-election next year. It is certain that they will see to it that there is no misunderstanding as to their attitude in this controversy. Moreover, it is a matter which concerns the Republican leaders. The party has had to run counter to the views of the West on certain agricultural questions, and the leaders are anxious that no affront may be given to those concerned with the West's other great industry—mining.

Bureau of Mines Develops New Classifier

Increased recoveries from lead and zinc ores are resulting from improvements which are being worked out in milling methods employed in southeastern Missouri. Engineers of the U. S. Bureau of Mines engaged in this work have just installed a new type of classifier which embodies improvements suggested by a long series of experiments. A means has been developed for determining positive efficiency numbers for the several spigots of the classifier.

Along with these experiments, the Mississippi Valley station of the Bureau is trying to make acid-grade spar from the low-grade fluorspar ores in the Illinois-Kentucky district. This has been found to involve complex problems. When rich ore is worked for commercial grades of gravel spar, a certain amount of dissemination does not interfere with results. Impurities must be eliminated, however, in the preparation of acid grade, and great difficulty is being experienced in separating all calcite and silica from the spar.

The non-metallic station of the Bureau at New Brunswick, N. J., has begun a study of the potash minerals in drill cores from the deposits in Texas and New Mexico.

As Mississippi bauxites are high in iron, their preparation involves a problem different from those of the ores of Alabama and Georgia. In experiments conducted at the Tuscaloosa station of the Bureau, it has been found that the iron minerals in the Mississippi ore do not crush as readily as do the other constituents. As a result, the coarse sizes run higher in iron than do the fine sizes. Just the opposite is true of the Georgia and Alabama ores. The fine sizes carry most of the iron.

Important Plans Under Way in British Columbia

Consolidated Equips Old Sport for Production—Premier Acquires Control of Prosperity

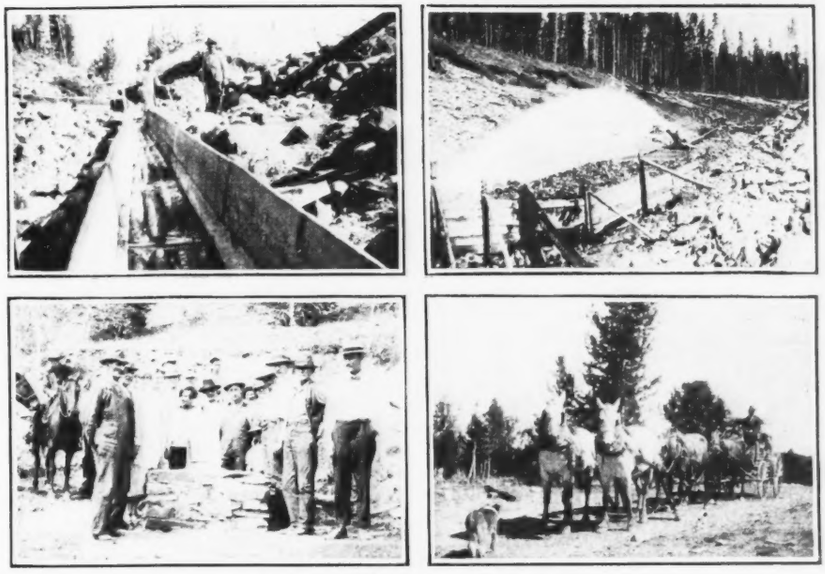
RECENTLY, J. J. Warren, president, and W. M. Archibald, manager of mines, of the Consolidated Mining & Smelting Co. of Canada, together with Lorne A. Campbell, managing director of the West Kootenay Power & Light Co., Consolidated's power subsidiary, made a lengthy inspection of the Coast Copper Co.'s Old Sport mine, at Quatsino Sound, Vancouver Island, which Consolidated controls. Arrangements have been made with the dominion government, whereby the wharf at Jeunee Landing is to be reconditioned and extended at once, to enable it to receive shipments of heavy machinery that Consolidated will forward to the Old Sport mine. Consolidated has been developing the mine steadily for several years and has blocked out a large tonnage of copper ore that in places carries also important gold values. Soon productive mining will be started.

In reply to a question as to the probability of Consolidated building a smelter either on Vancouver Island or on the mainland coast, Mr. Warren said that there was nothing further to be said on the subject at this time. The last statement by the company relative to this subject was that without doubt the company would be prepared to provide the service when it was assured that it was needed. At present not enough ore is available to maintain such a plant profitably.

Mr. Warren admitted that the Big Missouri mine, situated to the north of the Premier mine, "had been brought into the Consolidated family" and that engineers have been sent to the property to lay out the development to be undertaken. He also stated that about thirty men already were at work in extending the road from the Premier mine to the property.

The Premier Gold Mining Co. has acquired an additional 24 per cent interest in the Prosperity group, adjoining the Porter-Idaho mine, in the Marmot River section of the Portland Canal division. This brings the company's interest in the group up to 76 per cent. The company has driven 100 ft. on the vein from the point where it was intersected by the tunnel. Over this distance the vein averages 4½ ft. in width. It carries a good deal of flake silver and bunches of galena, but it is much oxidized and is not as rich as it was at the surface. The company is about to start another tunnel to open the vein at greater depth. A substantial camp is being erected, and about 120 tons of supplies have been shipped to the property, to carry on its exploration during the coming winter. The Premier company recently declared its usual quarterly dividend of 8 per cent, covering the third quarter of this year.

At the George Gold-Copper Co.'s property, near the head of the Bear River valley, in the Portland Canal division, control of which Consolidated acquired early in the year, two diamond drills have been in continuous operation for some months, and sixty men have been employed on road work. Consolidated has staked a millsite and a townsite along the banks of Bear River, and, as soon as the necessary machinery can be got to the property, will start to drive a main haulage tunnel above the millsite to develop the several veins at depth.



In the Leesburg district of Idaho

Scale of Operations Increases at Leesburg, Idaho

Much New Equipment Brought In—Several Additional Companies Formed to Exploit Gold Placer Ground of the District

MORE than usual activity prevails this season on the gold placer claims in the Leesburg basin of Idaho. Operations are on a larger scale than those of recent years, and several new interests have entered the district.

Bonanza Placers, Inc., which controls 1,430 acres of placer ground, is working a No. 4 hydraulic giant and plans to have two more in use before the end of the season. Four carloads of hydraulic pipe have been brought in from Salmon City, which is 14 miles east of Leesburg and is the shipping point for the mines in the district. Recent construction work on the Bonanza property includes the building of a 3 by 5 ft. bedrock flume and a miners' boarding house, and the erection of a sawmill which has cut 100,000 bd. ft. of lumber for use on the tract.

Seven miles west of Leesburg, Goff Brothers, who have successfully mined in the district during the last ten years, have 500 acres of ground on which they are operating one hydraulic giant.

Montana Mining & Live Stock Co., which holds ten claims, totaling about 1,000 acres, has put in a carload of hydraulic pipe, and expects to move pay gravel before the end of the season.

On Richardson bar, half a mile south of Leesburg, a group of leasers have installed a No. 1 hydraulic giant. Six miles north of Leesburg, Oregon interests have twenty men building a mile of flume and installing hydraulic pipe. This company also expects to begin active operations this season.

In the accompanying group of photographs, the upper left view shows a section of bedrock flume under construction; in the upper right, a No. 4 hydraulic giant is seen in operation at the Bonanza Placers property; the lower right view, taken on Leesburg Summit, shows the stage coach which runs between Salmon City and Leesburg; the lower left view was taken July 17, 1926, when a bronze tablet was dedicated to celebrate the discovery of gold at Leesburg sixty years before, in July, 1866. The text on the tablet reads:

> *GOLD*
>
> *was first discovered near this spot in July, 1866, by B. F. Sharkey, Elijah Mulkey, William Smith, Joseph Rapp, and Ward Girton. They founded the town of Leesburg, which led to the colonization of Leesburg basin, which produced $16,000,000 in placer gold. The settlement of Leesburg led to the creation of Salmon City, and the organization of Lemhi County. This tablet is erected in honor of the five discoverers. Dedicated July 17, 1926.*

Mexico City Letter

By W. L. Vail
Special Correspondent

Low Metal Prices and High Transportation Costs Close Small Mines

Mexico City, Sept. 29—Closing of mines of lesser importance continues to be reported from various parts of the country. In most cases the closure is caused solely by the low price of metals and the high cost of transportation. In a few cases the labor question enters into the situation, as in the recent troubles at Amparo, State of Jalisco, which are not yet permanently settled and which are entirely the result of Red fomentation. Fortunately for mining investments, the federal government is not in sympathy with the extreme Red laborites, and as a result it is a foregone conclusion that these elements cannot prevail. Foreign agitators among the Red ranks are being expelled from the country as rapidly as their obnoxious activities become evident.

According to statistics just published, accidents in mining camps are being considerably reduced by application of modern methods and more careful supervision. Out of a total of 25,426,362 man-shifts worked in 1925 there were 31,358 accidents and 378 fatalities. In 1926, when 24,938,070 man-shifts were worked, the number of accidents declined to 27,557 and fatalities to 269.

THE Treasury Department, after hearing protests from the various mining chambers of the republic, has decided to reduce the consular fees on materials imported for mines 50 per cent, that is from 10 to 5 per cent; a presidential decree has been issued accordingly, annuling the decree of May 25 of this year, increasing consular fees to 10 per cent. The new order takes effect Oct. 1. At the same time, the secretary of the Department of Commerce, Industry and Labor has been instructed to make a careful study of the mining situation, taking into consideration the difficulties that most of the companies are under as a result of the low price of metals, with the purpose of making certain tax concessions that will to an extent temporarily offset the disadvantages which have paralyzed so many properties.

In connection with the general plan to attract capital into mining development, the mining department is constructing a laboratory for the experimental treatment of rebellious ores and various minerals not now being mined. There are immense bodies of unexploited minerals in various parts of the republic, which the government hopes may be brought into production. In this connection survey parties will be increased in numbers with the intention of covering the entire mineralized zone. More intense work, however, will be immediately directed to sections of the country now being opened up by new railway lines or automobile roads, transportation being one of the prime inducements for new ventures. In the matter of automobile road construction consideration is being given to the demands of existing traffic as well as to the idea of creating new fields of operation in the mining and agricultural industries. In addition to federal assistance, it is proposed to get state aid and advances, and in some instances help from the larger mining camps which will receive immediate benefits. These loans are to be repaid in the form of a reduction in taxes over a period of years.

The Campo Morado mine, in the State of Guerrero, has suspended operations as a result of the low price of metals, high cost of fuel and transportation, and constantly increasing government taxes, according to statements of representatives of the General Development Co. The General Development Co., with New York capital, has been working the property for the last three years under a lease from the Reforma Mining Co. At the offices of the Reforma company it was stated that work would be resumed on the property within the next few months. It is believed that renewed operations will be made possible owing to the construction of an automobile road from the Balsas River to Coyuca de Catalan or Pungarabato, a distance of about 160 kilometers. A concession for this work has already been granted by the federal and state governments, to Carlos Figueroa. This concession carries a subsidy of 3,000,000 pesos—1,200,000 from the state government and the balance from the federal authorities, to be paid from mining taxes in the state over a period of twelve years. The road will be from 6 to 8 meters in width and asphalted. Work will start within the next six weeks and will be pushed rapidly, as construction has already been financed.

The Campo Morado property has been the principal mining center of the State of Guerrero for many years. It was opened in 1901 and has produced many millions of dollars. Originally a high-grade silver and lead producer, the ores have gradually decreased in value at depth, but are still sufficiently rich to guarantee profits, other conditions being favorable.

The Achotla mine, property of the Peñoles interests, in the same district, is employing a large force of men in construction and development work. The new 300-ton mill will be completed in a short time, and large sums are being spent by the company in building roads to connect the camp with the railway at the Balsas River. Several hundred miners, and their families, who have been left destitute by the closing of the Campo Morado mines, are being transported to other parts of the country by the federal government.

The Guadalupe y Cal y Canto and San Lorenzo y Precavida, property of the Purissima company, of Pachuca, has been let under a working contract to the Real del Monte interests, payments to be based on percentages of ores.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Third Important Surface Discovery This Year Made at Noranda

Toronto, Oct. 1 — Developments throughout the Rouyn district are most encouraging. New discoveries are being made from time to time, and the older properties continue to grow in importance. A recent surface discovery made on the Noranda has now been opened up, disclosing high-grade ore for a length of 70 ft. and a width of 40 ft. This is on the same line as the "A" and "B" bodies, and may possibly be found to be a continuation. It is the third important surface discovery made by Noranda during the current year, all discoveries being more or less accidental. The 400 and 500 ft. levels are now being opened up, and preparations are being made to continue the work of sinking the shaft.

On the Newbec property, in which some of the Noranda people are interested, a pit has been sunk to a depth of 16 ft.; at this depth the vein shows a width of 6 ft., carrying good copper values. This is a new company, with an authorized capital of 5,000,000 shares of $1 par, of which 3,800,000 are issued. The company is financed to the extent of $200,000.

RAPID WORK is being done in laying the steel on the new Rouyn branch of the Nipissing Central Railway. Only 9 miles of steel remains to be laid, approximately, and trains should be running into the camp in November. The contract called for the turning over of the road to the Nipissing Central on Dec. 1, and it is now obvious that the contractors will be ahead of schedule.

Within a short time details will probably be announced of the plan for refinancing the Amulet. Last spring the company had approximately $100,000 on hand, and it is believed that this has been added to through the sale of some treasury shares on the market, but this money is now about exhausted. Although the Amulet has developed into an important property, it will need a large sum of money to put it on a producing basis. A branch railway line will have to be constructed, a new shaft sunk, and new buildings and equipment together with a mill, will be necessary. The ore is of such a nature that all of it must be concentrated. Diamond drilling continues to show new ore, and recent holes have considerably enlarged the No. 2 orebody.

An official statement of the Harvie Exploration Co. reports the discovery of three orebodies within the last two weeks. Two ore zones have been located, one running in a north-south direction, the other in an east-west direction. On the latter a diamond drill hole cut 70 ft. of low-grade ore and 15

ft. of ore of commercial grade. Two other orebodies have been encountered, one of which is being drilled and the other developed by underground workings from the 100 level.

Good reports are being received from the Goudreau district, where the Nipissing Mines has an option on the Kozac property. Lenses of ore are found in the schisted zone over a width of more than 100 ft. and these carry substantial values in gold and silver. The most interesting feature of this occurrence is the high proportion of silver. Of the total values, approximately two-thirds are silver and one-third is gold, the silver being found as a sulphide. A small amount of lead occurs, but the percentage of lead is not sufficient to account for the silver values.

Hollinger Consolidated Gold Mines has decided to drop its option on the Hill-Tivy-Sloan group of twenty-seven claims in the East Clearwater Lake section of Patricia.

Kirkland Lake Gold has started sinking the main winze below the 2,475 level. The management has not set any objective, but will continue to sink and open levels. Within six months the company expects to have several new levels under development.

On the 19, or 2,230-ft., level of the Teck-Hughes mine, Kirkland Lake, crosscutting has shown more than 12 ft. of good ore, and appearances indicate that greater widths may be found. This is the lowest level of the mine. Developments on the new 14 and 15 levels also continue to be satisfactory, and over 100 ft. in length of high-grade ore has been opened on these levels.

WRIGHT-HARGREAVES has again started sinking, and will continue the north shaft from 1,500 to 2,000 ft., which will permit the opening up of four new levels. Development of the east and west extension of the two veins is rapidly adding to the size of the property. From the 1,250 level west, 500 ft. of new high-grade ore has been developed. On the south, vein extensions are being found to the east, and 900 ft. of ore has been opened up, but the grade is lower than the north vein.

The Lake Shore is sinking from the surface to connect with a series of vertical raises which will be enlarged to the shaft size of 14x17 ft. Sixty feet of sinking has been done from the surface, and with a further 140 ft. connection will be made with the raises, so that early next year there should be a new shaft through to the 1,000 level. As soon as this point is reached sinking will be continued to 1,600 ft., which is the present lowest level of the mine. This new shaft will provide two outlets, and, with the present shaft available entirely for the hoisting of ore, it is expected that 1,500 tons a day can be hoisted.

Barry-Hollinger's new oreshoot on the 1,000 level has now been opened for 155 ft. and gives excellent values across a width of 5 to 6 ft. At present the mill is handling 50 tons a day, but it is expected that within a few days this will be raised to 120 tons.

London Letter

By W. A. Doman
Special Correspondent

Interest Centers on Tin—Position Still Weak as Demand Slackens

London, Sept. 27—Interest at the moment centers largely on tin, which has experienced a fall of about £25 per ton during the last month. The position is still weak, and this is thought to be the result of the slackening of American demand, the poor canning season—the canners are reported to have overbought the metal last year—and the absence of any pronounced increase in mid-European consumption. In addition, there is the depression in the Welsh tin-plate industry. As was pointed out last week, production has increased slightly, but this would hardly account for the slump. There has been, however, some extensive gambling on this side, and it is reported that certain syndicates, having speculated heavily, are now being severely handled. Consequently, with the price unsteady there is difficulty in selling. Those in close touch with the producing concerns of the East express no anxiety on the matter. There has been very little real offering of high-class holdings, though the share market has lately been a happy hunting ground for the professional bears.

Wiluna Gold, in the East Murchison district of West Australia, appears to be doing better under the present management, which is a compound of the Huronian Belt, Consolidated Goldfields of South Africa, and local groups. H. E. Vail has opened up the East lode at 290 ft. and 400 ft. and the West lode at 200 ft. and 300 ft. A pilot plant is in operation experimentally, and half of it is being worked by Minerals Separation process, the other half by dry crushing and roasting. The last-named method is favored, but as the gold extraction is not quite satisfactory—a considerable percentage being lost as dust or in fumes—an addition is being made to the plant of an apparatus such as is used in refineries to obviate this waste. As this is unusual metallurgical practice at gold mines, the results will be awaited with interest. Meanwhile costs are heavy, and additional capital will no doubt have to be provided. The West Australian government is considering the question of extending the railway to the Wiluna district.

Owing to conditions in China, higher costs of steel, tin, and transport, and a poor canning season in many countries, some of the South Wales tin-plate manufacturers are experiencing thin times, the industry for the last three months having been working at less than 70 per cent of capacity. On the other hand, there seems little likelihood of any material decline in the price of the metal, notwithstanding the fact that new Eastern tin companies are constantly making their appearance. It is doubtful, however, whether increased production will more than counterbalance exhaustion of some of the older properties and the normal growth of demand. Exports from the Federated Malay States last month were 100 tons less than for July, and the producing concerns such as Tronoh, Kamunting, Idris, and Malayan are showing increased earnings and making excellent dividend distributions.

When the price of De Beers fell heavily a short time ago the movement was attributed to the position of the diamond market. The result was that many persons on and around the stock exchange went short. It is now said that Jack Joel, being in poor health, is retiring from the firm of Barnato Brothers, and has sold his interest in De Beers, being content to possess securities that move in a less animated manner. Some speculators have burned their fingers.

Since rather a good deal was expected in the way of discovering base metals in the district of Ankole, Uganda, by the Kaduna Syndicate and Kaduna Prospectors, considerable disappointment has now been expressed at the announcement by both companies that the license has been abandoned. So far the announcement has not had any effect on other tin prospecting companies in the country.

ALTHOUGH it has experienced many vicissitudes, the directors of the Waihi Gold Mining Co., of New Zealand, have always pursued a sound financial policy by retaining large sums from profits and investing them in high-class securities. Some shareholders now want to "touch" deferred profits, and have suggested that the company might become a kind of investment trust. Having considered the position, the directors are putting forward the alternatives of doubling the capital and issuing one new share fully paid for each share held, with the view of a general finance and investment business, and the exploration of other properties, or giving 10s. in 6 per cent debenture stock, repayable at the end of 1932, to meet the views of those who wish to confine operations to the Waihi mining area.

More Activity in Breckenridge District

Robinson, Marz & Sauers are reopening the railroad tunnel of the Dunkin mine, on Nigger Hill, in the Breckenridge district of Colorado. They also hold a lease on part of the adjoining "86" property. By virtue of this lease they are in a position to follow the Dunkin vein.

Tunnel work is being pushed by R. E. Myers, superintendent of the Jumbo Mines Co. At a distance of 372 ft. from the portal an 18-in. vein of iron carbonates was encountered. It is expected that the old gold-ore vein of the Jumbo will be opened up at a distance of about 400 ft.

Campbell Shaft of Calumet & Arizona in Large Orebody

Operations in Warren District Developing Immense Deposit —Not Rushing Production

CALUMET & ARIZONA is developing in its Campbell shaft, in the Warren district of Arizona, an immense orebody much larger in all dimensions than the original deposit in the famous Irish Mag shaft, which started the company on its career as one of the largest producers of copper. Neither the top nor the bottom of the deposit has yet been found. The present top is at the 1,400 level, and the lowest workings are at the 2,200.

The Campbell shaft is down to the 1,800 level, but the minor lens of the great deposit has been opened by a crosscut from the Junction shaft. The length of the crosscut to the point directly under the Campbell shaft is 2,500 ft., and it extends 100 ft. beyond. It has passed through 15 ft. of high-grade ore and 100 ft. of mineralized pyrite, which checks up with the minor lens on the 1,800 level. Raising from the 2,200 level ultimately will connect the shaft with the crosscut.

On the 1,800 level the orebody has been penetrated for 600 ft., and it may extend even beyond this distance. The ore assays from 5 to 30 per cent, but an estimate of the average for the whole orebody probably would be nearer the 5 per cent grade than the 30. The Irish Mag orebody, which put Calumet & Arizona into the ranks of the dividend payers, averaged better than 8 per cent. It is not possible at this time to estimate the tonnage in the new deposit, which can be done only after its full extent is determined. It is known, however, that the tonnage will be immense, surpassing that of the original deposit in the Irish Mag.

At present only two small stopes, from which ore is taken occasionally, have been established on the 1,800 level. The only other ore now coming from the new deposit is that taken out in opening work. Meanwhile the orebody now being mined in the Campbell shaft continues to hold up well in values, and a raise put through from the 1,800 to the 1,600 level is through ore yielding 25 per cent.

Calumet & Arizona is not pushing production, on account of the low price of the metal, and it is probable its output will not touch again this year the 5,000,000 lb. per month mark. New Cornelia's production in 1927 will be 10,000,000 lb. under that of 1926.

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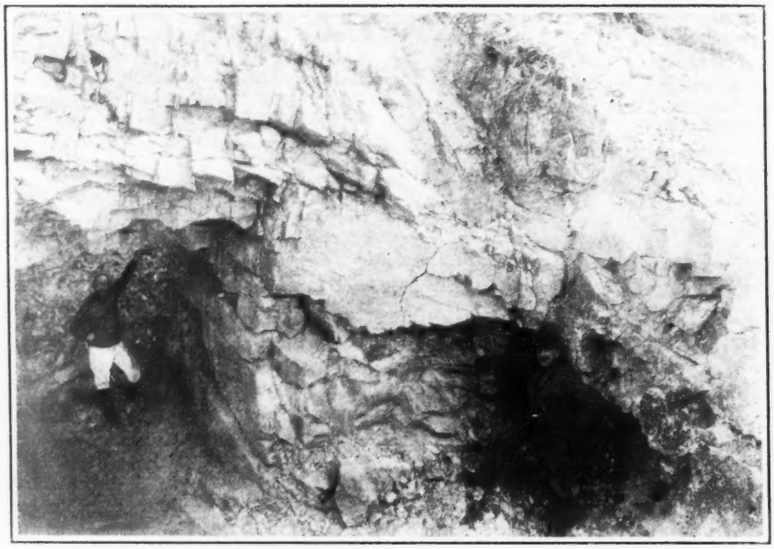
Feldspar Deposits Developed Near Pringle, S. D.

Extensive feldspar-beryl-mica deposits are being developed by the Dakota Feldspar Co., four miles east of Pringle, in the Black Hills of South Dakota. The ore occurs in a vein 16 to 20 ft. wide, which is clearly defined for a distance of about 575 ft. Two other veins of feldspar outcrop on the surface of the property. A crosscut tunnel 230 ft. in length cutting the three veins at a depth of 120 ft. below the outcrop has been driven, and a stope 150 ft. in length, 12 ft. wide and 40 ft. high has been made in mica-mining operations on the property. A view of one of the veins is shown in the photograph above.



One of the workings of the Dakota Feldspar Co.

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Prospecting Conditions Hard in New Guinea

Native Carriers Often Treacherous— Government Restrictions Severe —Airplane Service Proposed

PROSPECTING conditions in British New Guinea, where numerous gold finds have recently been made, are not of the best, according to reports. The new fields are situated about one hundred miles from civilization, and to get to them it is necessary to traverse dense jungle regions, commonly known as "razor-back" country. Prospectors have to depend on native carriers, not only to assist them with their packs but also to act as guides. These natives are often very treacherous, as a recent incident demonstrated. In this instance, several natives, after being paid beforehand to take a group of miners through the wilds to the new fields, went with them a certain distance and then absconded, in order that they might go back to the starting place and engage with fresh parties, waiting in town for carriers to assist them to their destination. To make things worse, no white labor is to be had on the island, so that the prospectors and others are greatly dependent on the natives. The natives appreciate the situation and will not engage their services until they have been fully paid for the journey to the fields.

The present rush is causing quite a stir among old prospectors and others in Australia, but restrictions imposed by the government are rather severe. All those desiring to prospect in New Guinea must first pass a health and character test and they also have to possess $5,000 before they are allowed to proceed to the fields. These restrictions are undoubtedly wise, as in previous gold rushes to New Guinea great hardships have been borne by many who took part in them. In quite a few instances people were robbed and even massacred by outlaws, who had been allowed to make the trip with the rest of the crowd. The government is attempting to remove any possibility of a repetition of such acts. As a result of these restrictions, however, many men are sailing in small crafts to parts of the island outside of British territory, and tramping inland until they cross the border to where the new finds are situated.

To obviate the difficulties of transportation from the coast to the fields, an aviator recently left Sydney with the idea of establishing an airplane service over the hundred miles' stretch, thus making the trip inland comparatively easy for those awaiting to make the journey.

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Montana-Idaho Takes Over Spring Hill Mine

The Montana-Idaho Mines Corporation, which has been operating three properties near Winston, Mont., has taken over the Spring Hill mine, 4 miles southwest of Helena, in the Unionville district. The property is said to have in sight around 250,000 tons of gold ore of good grade which will be treated by the cyanide process. New machinery for the property has been ordered, and a contract given to Charles J. Jacoby & Sons, of Helena, for construction of the mill foundations and mill building. The mill will have a capacity of 150 tons per day. Arrangements are being made to install electric power. As soon as the mill is in operation, development work will be started to put more ore in sight on the lower levels.

Situation at the Mines

Tendency Toward Gradual Increase in Output Noticeable in Several Non-Ferrous Metal-Producing Districts—Slight Curtailment Continues

By H. D. Keiser
Assistant Editor

SENTIMENT in the non-ferrous metal-mining districts continues to show improvement, although no general increase in production is as yet noticeable. Limited curtailment still prevails. In some sections, however, properties which have been closed for months are resuming operations and new properties are being opened, with the result that production in these districts is gradually increasing. Many companies have extensive exploration and development programs in progress, apparently in the hope that greater production will soon be warranted.

Copper

Production by the mines of the Michigan copper district in September was approximately 14,500,000 lb., refined. This output is slightly under the normal rate, and is the result of no production by Seneca, which is idle, and Quincy's underground fire, which put No. 2 shaft, its principal producer, temporarily out of operation. The labor situation continues most satisfactory, with all mines well supplied with adequate forces. Considerable exploratory and development work is being pushed by Calumet & Hecla Consolidated and by independent companies. Shipments by boat from smelters in the district totaled 7,412,000 lb. for the month. Of this amount, 4,308,000 lb. was shipped from the docks of Calumet & Hecla Consolidated at Torch Lake; 3,064,000 lb. was loaded at the Michigan smelter docks at Houghton, representing Copper Range and Mohawk metal; and Quincy moved only 40,000 lb. by water. Business has been light and only a small amount of metal was moved by rail in September.

Although the average price of copper for September was practically the same as that for August, and a slightly greater demand prevailed, there was no material increase in production at the Arizona copper mines. The best strike of the month was made by the Magma Copper Co. at Superior, in the company's new hoisting shaft, at a depth of 2,150 ft. As this find is 1,000 ft. west of the present orebody, it may indicate another oreshoot in the vein. The Copper Queen branch of the Phelps Dodge Corporation completed the half-mile drift connecting its C. & C. water shaft with the new Dowell shaft in Warren.

In Canada, recent surface discoveries on the Noranda are developing important sections of high-grade ore. Diamond drilling on the Amulet continues to enlarge the size and importance of the orebodies, and Towagmac developments on the 500 level indicate the largest and most cheaply minable orebody in Rouyn. In the Sudbury district a new high-grade copper discovery is reported at depth in the Creighton mine of the International Nickel Co.

Lead and Zinc

The tendency toward increased output continued during September in the Joplin-Miami district, the total weekly production toward the close of the month exceeding 17,000 tons, whereas the high point for the preceding month was slightly more than 16,000 tons. Net unsold stocks, however, instead of decreasing as in August, increased from 25,000 to 35,000 tons. The total number of mills operating rose from 136 to 144. For the week ended Oct. 1, production of zinc concentrates amounted to 15,694 tons, of which 1,489 tons was high-grade ore and 1,306 tons was produced by tailing mills. Output of lead concentrates for the week was 1,972 tons; of the 144 mills operating, twenty-eight were treating tailings.

Continued low metal prices for lead and zinc, which prevailed throughout September, had no perceptible effect upon production in the Coeur d'Alene district, Idaho, which was maintained at practically the same rate as in August. In fact, though low prices—special reference being made to lead—have been disappointing throughout the year, there has been only slight curtailment of production and much new development has been carried on, as a result of which two new producers are about to enter the list—namely, Cedar Creek and Dickens Consolidated. At the former, a mill of 100 tons' capacity is under construction and is expected to be in operation sometime in November; at the latter, a mill of 200 tons' capacity is expected to be under construction within the next few weeks.

Lead-Silver

Production at the lead-silver properties in Utah continued practically unchanged during September; toward the close of the month shipments increased slightly in the Park City and Tintic districts and declined to a small extent in the Bingham district. Many of the companies have considerable development work in progress; Park-Bingham is developing its properties in the Bingham and Park City districts, and Park King is beginning the deep development of its property, adjoining the Park Utah mine at Park City.

Treadwell-Yukon Co., which has under option a large portion of the Tybo section in the Hot Creek district of Nevada, is satisfactorily developing the area and may erect a treatment plant in the district. The recent consolidation of the San Rafael, Calico, Exchequer, and San Felipe companies, operating in the Quartz Mountain district, has had the effect of decreasing production from the district during the last month. Considerable development work, however, is under way at the properties.

Gold and Silver

September shipments of bullion from the mills of the Tonopah district had a total value of $162,000. Of this amount, $25,000 was contributed by the Divide district, where leasers working the Tonopah Divide and Brougher mines were chiefly responsible for the increase over that district's $15,000 yield of the preceding month. Production in the Gold Circle district showed no change, being valued at about $35,000 again. In the Virginia City area, the 200-ton cyanide plant of the Flowery Mines Co. is working at capacity, and developments in the adjoining Lady Bryan mine, which is under option to the Flowery company, have disclosed a substantial tonnage of milling ore of good grade. The Weepah camp continues quiet.

Iron

The shipments by water from the Lake Superior region during September amounted to 7,230,881 tons, a decrease of 2,390,875 tons from the same month of 1926. The total for the season to Oct. 1 was 42,387,376 tons, a decrease of 2,843,532 tons from the corresponding period of last year. It is estimated that the end of the period of navigation on the Lakes will record a movement of 55,000,000 tons, which will be in line with estimates made early in the year. The inspector of mines for the Marquette range reports twenty-three mines in operation this year—two more than a year ago; but there has been a slight decrease in the number of men employed in all departments. Unless there is an improvement in the steel business, the mines will not be rushed during the coming winter months. Operations will continue at the present rate until the open-pit mines are closed, about the middle of November.

On the Mesabi range, all the mines are moving ore out as fast as the furnaces can take it. At the present pace, the two heaviest shippers this year will be the Missabe Mountain pit, at Virginia, and the Hull Rust, at Hibbing, both of which will have a credit of more than 6,000,000 tons when the season closes. The M. A. Hanna Co. has pulled the pumps at the Shiras mine, near Buhl, Minn., and will relinquish the lease. Some ore remains on the property, but it is too low grade to mine.

Societies, Addresses, Reports

San Francisco Engineers' Club Dedicates Home

THE goal of many years' endeavor was reached by the Engineers' Club of San Francisco when its new home was dedicated on Sept. 30. This club, which is now fifteen years old, includes in its membership engineers engaged in all branches of the profession, the total membership being about 750. Because San Francisco is far from the headquarters of the national engineering societies, the club has made a point of close relationship with these organizations. The four founder societies, in conjunction with the club, conduct an employment service in San Francisco and thirteen branches of national technical societies hold meetings at the club. The new quarters occupy the two top floors of a new building at Pine and Sansome Sts.

At the dedication ceremonies congratulatory wires were read from Herbert Hoover, who is a member of the club; Charles M. Schwab, president, American Society of Mechanical Engineers; H. Foster Bain, secretary, American Institute of Mining & Metallurgical Engineers; W. S. Sproul, president, Southern Pacific R.R.; James H. McGraw, Jr., vice-president, McGraw-Hill Publishing Co.; Calvin W. Rice, secretary, American Society of Mechanical Engineers; and others. The club takes possession of the new quarters practically free of debt, without assessments or borrowed money.

The address of dedication, by N. A. Bowers, the president of the club, who is Western editor of *Engineering News-Record*, stressed particularly the opportunity and the obligation of the club to render service of high order to the engineering profession as a whole. Other addresses were as follows: "The Engineer from the Viewpoint of Finance," by F. L. Lipman, president, Wells Fargo Bank & Union Trust Co.; "The Engineer's Place in Industry," by Charles W. Merrill, metallurgical engineer; "The Public and the Engineer," by Chester H. Rowell, editor and publisher.

Mining Section Reviews Accident-Prevention Work

Nearly one hundred mining men, representing about equally the metal and coal divisions of the industry, attended the sessions of the mining section at the sixteenth annual safety congress of the National Safety Council held in Chicago during the period of Sept. 26-30.

The papers presented at the meetings covered numerous phases of accident-prevention work and reviewed in detail the results achieved at many of the largest mining centers in the country. Announcement was made that during the year company and individual membership in the section had increased from 227 to 236.

Among the papers presented were: "Statistics and Their Bearing on Accident Prevention," by H. G. Hensel, safety director, Youngstown Sheet & Tube Co.; "Foremanship Training Conferences and Their Bearing on Accident Prevention," McHenry Mosier, superintendent of mines, Phelps Dodge Corporation; and "The Effects of Mine Dust on Health," F. W. Meriwether, M.D., U. S. Bureau of Mines.

In his paper on statistics, H. G. Hensel stated that statistics alone will not prevent accidents, and are a waste of time if not used to advantage. Short, snappy statements of the week's or month's record, the number of lost-time accidents, and comparisons with the records of other mines in the same company, or with last month's accident record, if placed on the bulletin board, will reach the miners and other labor, he said.

Though McHenry Mosier attributed much of the improvement in mine safety at Morenci to foremanship-training conferences, he also gave credit to the increasing desire of the management to reduce accidents, the closer supervision, better co-operation, analytic investigation of all accidents, standardization, better instruction of workmen, better discipline, first aid, increased plant pride, and small labor turnover.

Dr. Meriwether reviewed the physiological effects of dust on mine workers, and stressed the importance of periodic X-ray examinations of the mine worker. Such examinations, he said, if acted upon, would, in many instances, effect the recovery of the worker and protect the employer against the payment of considerable compensation.

Will Follow Up Economic Conference Work

The Assembly of the League of Nations at its recent session established a permanent advisory committee which will carry on under the direction of the League the work initiated at the International Economic Conference last May. The United States is to be invited to name representatives in this committee, even though it is not a member of the League.

There has also been called to meet in Geneva this month a diplomatic conference to draft international agreements for the abolishment of export and import prohibitions. The United States has been invited to send representatives and has delegated Hugh Wilson, American Minister to Switzerland, together with several technical advisers from the Department of Commerce, as the American delegate.

"Security Wage" Need of Worker in Industry

A "SECURITY WAGE," by which the worker in industry has a margin above basic living costs to make his own provision against sickness, unemployment, and old age, should be an objective in all industry, Edward J. Mehren, vice-president and chairman of the editorial board of the McGraw-Hill Publishing Company, told the New York Building Congress at a luncheon in the Hotel Commodore on Oct. 5. The "security wage," he added, gives the worker independence and removes the necessity for his reliance upon state insurance schemes.

In his talk, Mr. Mehren described for his hearers the movement for reduction of production costs which industry in all parts of Europe, notably in Germany, is pushing through to success. It has dawned on the manufacturer in Germany, the speaker said, that well-paid workers are good customers and that good customers keep factories busy. Of course, the manufacturer is not rushing at once to raise wages, but his former resistance to wage increases is tempered by the conviction that his prosperity is tied up with his workers. Further, labor in Germany sees that the means for raising the wages of the workers will come from the savings effected through the cost-reduction movement.

"The significance for America in these cost-reduction efforts lies in the new grip which they give Europe in foreign markets," said the speaker. "In fact, they will help in the constant effort to sell here in America in competition with our own industries. With Germany under the terrific urge of a lost war, adopting our production methods, often using American machinery, and with a lower wage scale, we shall be hard put to it to match her costs. We may, to an extent, keep her out of our markets by the tariff, but we can meet her in foreign lands only by producing at the world price. Further, while the American people have always stood for a certain amount of dumping—that is, the sale of products abroad for less than they are sold here—it is doubtful whether they will stand for it on a grand scale. Should they refuse to permit it, the tariff walls will be lowered and we shall need more than ever to manufacture at or below the world price."

Civil Service Examinations for Mining Engineers

The U. S. Civil Service Commission announces competitive examinations for the positions of associate mining engineer and assistant mining engineer.

Applications for the examinations must be on file with the Civil Service Commission at Washington, D. C., not later than Nov. 8, 1927. Full information concerning the examinations may be obtained from the U. S. Civil Service Commission, Washington, D. C.

Recent Technical Publications

ELECTRICAL PROSPECTING BY THE SCHLUMBERGER PROCESS. C. and M. Schlumberger, 30 Rue Fabert, Paris. Free on application to Schlumberger Electrical Prospecting Methods, 25 Broadway, New York City.

The circular explains the principles on which the "Potential Method" is based and contains a number of illustrations of the application of the method to problems met with in the field. A briefer account of the "Spontaneous Polarization" method is given, and the pamphlet concludes with a list of companies that are using the Schlumberger methods.

STATISTISCHE ZUSAMMENSTELLUNGEN. Compiled and published by the Metallgesellschaft, Frankfurt-on-Main, Germany.

These comprehensive metal statistics are published yearly, and the 1926 edition of the book is up to the high standard set by its predecessors. The statistics cover aluminum, lead, copper, zinc, quicksilver, silver and tin. The first pages of the work are devoted to a résumé of comparative world production and prices, taking the 1909 to 1913 average as the index. It is interesting to note that taking this index as 100, the world production of aluminum in 1926 was 403. No other production has, of course, increased to anything like this extent; copper makes the next best showing with 155. The pages following are devoted to tables giving production and consumption by continents, and then follows the most important feature of the book, production and consumption by countries. The tables are made clear to those who are unable to read German by a preface printed in English, French, and Spanish. This preface also explains how the tables have been compiled and what the figures mean. In the concluding pages these are some interesting metal price comparisons, the New York and London prices being set forth side by side and then reduced to a common basis of dollars per metric ton.

PRIVATE OWNERSHIP OF PUBLIC LANDS.—The private ownership of public land, now held by the government in Western states, is favored by a majority of representatives and leaders in various occupations scattered throughout the country, according to an announcement of the American Mining Congress, which in its September *Mining Congress Journal* features a discussion of this national question. This is the second of a series of special articles and editorial discussions on five national issues terminating in December with a symposium of public opinion on taxation. These "public opinion" series began in the August *Mining Congress Journal* with a consideration of railroad consolidation, and the other discussions will be on the "Five-Day Week" in October and "Government Ownership" in November. The *Mining Congress Journal* is published by the American Mining Congress, Munsey Building, Washington, D. C. Price 30c. per copy.

PATENTS

TRUCK FOR MINE CARS. No. 1,643,298. Sept. 27, 1927. James R. Fleming, Scranton, Pa.

A new type of axle having a tapered end fitted with a shoulder. The bore of the wheel is also fitted with a corresponding shoulder and is held on the axle by a pin which passes through the wheel and the tapered portion of the axle.

SILVER SILICON ALLOY AND THE PROCESS OF MAKING SAME. No. 1,643,304. Sept. 27, 1927. Michael G. Korsunsky, Jackson Heights, N. Y. Now by judicial change of name, Michael George Corson, assignor to Electro Metallurgical Co.

An alloy containing silicon in the amount of from 1.5 to 6 per cent and 1 to 50 per cent of a member of the group of metals characterized by the formation of a solid solution with silver.

CORE DRILL. No. 1,643,338. Sept. 27, 1927. Halbert B. Halvorsen, Chicago, Ill. Assignor to Sullivan Machinery Co.

A device consisting of a secondary core barrel rotating in the outer core barrel and fitted with a ball thrust bearing.

ROCK DRILL. No. 1,643,563. Sept. 27, 1927. Gustave M. Nell, Denver, Colo., assignor to the Denver Rock Drill Manufacturing Co.

A new feed device for stoping drills.

FURNACE FOR HEATING OR MELTING METALS. No. 1,643,569. Sept. 27, 1927. Artur Zilliacus, Dalsbruk, Finland.

A furnace with a device for producing a layer of protective gas which envelops the metal on the hearth.

PROCESS FOR RECOVERING METALS FROM SLAG. No. 1,643,610. Sept. 27, 1927. Fred Rosenzweig, Pittsburgh, Pa.

A process for recovering metal from the metallic oxides contained in blast-furnace slags. The slag is caused to flow, while still molten, into a series of receptacles in which an electric current is applied and the oxides are reduced and the metal collected.

MINE AND OTHER CAR. No. 1,643,687. Sept. 27, 1927. Audley Hart Stow, Charleston, W. Va. Assignor to Edith S. White, Caldwell, N. J.

A device for a rotary axle journal box.

TUNNEL VENTILATING. No. 1,643,868. Sept 27, 1927. John Matthew Woll, Kittanning, Pa. Assignor of one-third to John Jacob Lippuner, Oregon City, Ore.

A device by which air is admitted to tunnels through ducts in the floor and drawn out through corresponding ducts in the roof.

PULVERIZER. No. 1,643,874. Sept. 27, 1927. Richard L. Cawood, East Liverpool, Ohio.

Design for a high-speed impact pulverizer.

DISINTEGRATING MACHINE. No. 1,643,938. Oct. 4, 1927. Diedrich C. Addicks, Ragland, Ala.

New design for an impact pulverizer.

MINE CARS. Nos. 1,644,009; 1,644,010; 1,644,011; 1,644,012. Oct. 4, 1927. Glenn E. Edmunds, Columbus, Ohio, assignor to the Bonney-Floyd Company, Columbus, Ohio.

Various designs in connection with mine cars.

CENTRALIZER FOR DRILL STEELS. No. 1,644,026. Oct. 4, 1927. John F. Mock, Phillipsburg, N. J., assignor to the Ingersoll-Rand Co.

A device which can be mounted on the guide ways of a rock drill shell to center the drill steel.

HANDLE FOR ROCK DRILLS. No. 1,644,030. Oct. 4, 1927. William Prellwitz, Easton, Pa., assignor to Ingersoll-Rand Co.

New design for rock drill handle.

APPARATUS FOR CONCENTRATING MATERIALS, such as Coal. No. 1,644,112. Oct. 4, 1927. Emil Diester, Fort Wayne, Ind.

Design for a dry concentrating table.

CONCENTRATING TABLE. No. 1,644,113. Oct. 4, 1927. Emil Deister, Fort Wayne, Ind.

Design for a new type of concentrating table.

DRILLING MACHINE. No. 1,644,120. Oct. 4, 1927. George H. Gilman, Belmont, Mass.

New design for rock drill.

SCRAPER. No. 1,644,252. Oct. 4, 1927. John S. Housman, assignor to Goodman Manufacturing Co., Chicago, Ill.

A new design of scraper carrying projecting prongs which extend in front of the body of the scraper and serve to dislodge loose material.

OPTICAL PYROMETER. No. 1,644,340. Oct. 4, 1927. George Keinath, Berlin-Charlottenburg, Germany, assignor to Siemens and Halske Aktiengesellschaft, Berlin, Germany.

An optical pyrometer designed for use at considerable distances from the source of heat.

PROCESS OF PURIFYING CADMIUM. No. 1,644,431. Oct. 4, 1927. Henry Howard, assignor to the Grasselli Chemical Co., Cleveland, Ohio.

Cadmium sponge is treated with caustic soda solution at its boiling temperature. This dissolves the zinc content of the cadmium.

MINE CAR BRAKING MECHANISM. No. 1,644,474. Oct. 4, 1927. John A. Hebb, Hopwood, Pa.

Design for brakes operated by hand levers on the outside of the body of the car.

Personal Notes

J. T. CANFIELD may be addressed at Privada del Tiber 5 B, Mexico City.

HERMAN GUNTER has been reappointed State Geologist of Tennessee by Governor Martin.

Sir ERNEST and Lady OPPENHEIMER left Johannesburg on Aug. 23rd for a short visit to England.

GEORGE H. GARREY has returned to Philadelphia from examination work in Nevada and California.

E. R. CRUTCHER has been appointed zinc plant metallurgist of the Sullivan Mining Co. at Kellogg, Idaho.

H. M. TABERER, native labor adviser to the Chamber of Mines, has returned to Johannesburg after a visit to Europe.

M. K. CAMPBELL, JR., manager, Minas Del Tajo, at Bolanos, Jalisco, Mexico, is in San Francisco on a short visit.

R. E. PHELAN, manager of the Flin Flon option, has returned from Manitoba to San Francisco and is on his way to New York.

H. T. HAMILTON, of San Francisco, has accepted a position in the industrial department of the New York Trust Co. and has left for the East.

SHERWIN F. KELLY, of C. & M. Schlumberger, is in San Francisco in the interests of the Schlumberger electrical prospecting methods.

L. H. METZGAR, general superintendent of the Alaska Juneau Gold Mining Co., has returned to Juneau after a short vacation in San Francisco.

MALCOLM FERGUSON, Inspector of Mines, Krugersdorp, left Randfontein recently for Cape Town, en route to England, on a four months' visit.

WILLIAM HUFF WAGNER, mining engineer and geologist of the firm of Wagner & Houchins, Washington, D. C., has gone to Mexico on professional business.

ALEX WISE, president and general manager of the Flowery Mines Co., operating a low-grade gold property in Six Mile Canyon, near Virginia City, Nev., is in San Francisco.

GEORGE OTIS SMITH, director of the U. S. Geological Survey, is on a tour of inspection of field offices under his administration throughout the country as far west as the Pacific Coast.

KARL EILERS, consulting metallurgist, has been unanimously elected a director of the American Institute of Mining and Metallurgical Engineers to fill the vacancy created by the death of Charles F. Rand.

S. R. CAPPS, R. H. SARGENT, and J. B. MERTIE, JR., of the Alaskan Branch of the U. S. Geological Survey, have returned to Washington, D. C. P. S. SMITH was expected at headquarters on Oct. 17.

NORMAN R. FISHER, consulting engineer, is making an examination of the property of the Kirkland Premier, in the Kirkland Lake area of northern Ontario, where an extensive program of development is being arranged.

M. E. FISHER, of Wallace, Idaho, ore-buying representative in the Coeur d'Alene district of the American Smelting & Refining Co., is spending the month of October on vacation at his former home in Pueblo, Colorado.

MARSHALL W. TUTHILL, of New York, has been designated by Secretary Hoover to be chief of the newly

Harris & Ewing

M. W. TUTHILL

created minerals division of the Bureau of Foreign and Domestic Commerce.

HARRY V. WELCH, chief chemist of the Western Precipitation Co., Los Angeles, recently sailed for Australia, to supervise an installation of the electrical precipitation process in the Newcastle plant of the Broken Hill Proprietary Co., Ltd. He will stay in Australia for several months.

W. H. FINKELDEY has resigned his position as assistant chief of Research of the New Jersey Zinc Co., with which he has been connected for the last ten years, to become associated with the firm of Singmaster & Breyer, consulting chemical and metallurgical engineers, 420 Lexington Ave., New York City.

C. H. POIRIER, mining engineer of New York, representing important financial interests, is investigating mining opportunities in the Thunder Bay district of northern Ontario. He states that there is much interest in New York in mining and financial circles in the mineral resources of northwestern Ontario.

DOUGLAS G. H. WRIGHT, mining engineer and geologist, who has been prominent in connection with the development of the Red Lake gold field, has been retained by the mining brokerage firm of R. O. Denman & Co., of Toronto, as consulting engineer to advise in the selection of mining securities for investment.

Dr. T. L. TANTON, of the Canadian Geological Survey, has been making an investigation into the reported discovery of placer gold at Fort William, Ont. He expressed himself as convinced of the genuineness of the discovery, but stated that much prospecting would have to be done before its commercial value was definitely ascertained.

SALI HOCHSCHILD, of Santiago, Chile, has left Santiago for a visit in Europe. Mr. Hochschild expects to be in New York about the end of November or the first part of December for a short visit before returning to Chile. While in New York Mr. Hochschild will make his headquarters with Thomas F. Donnelly at 135 Broadway.

J. B. TYRRELL, of Toronto, a mining engineer long associated with the development of Canadian properties, has been elected president of the Champlain Society. Mr. Tyrrell has been actively interested in the work of the society and has edited two of the most successful publications, "Samuel Hearne's Journey" and David Thompson's "Narrative."

Prof. F. C. LINCOLN, of the South Dakota School of Mines, has returned to his desk at Rapid City, S. D., after a summer spent as manager of the Northwestern Quarry Co., which operates a quarry and a crushing plant 5 miles north of Rapid City. During the summer Professor Lincoln installed a new crushing plant at the property, regular production being maintained throughout the season.

LOUIS D. HUNTOON returned to New York on Oct. 6 after making three examinations in the Sudbury area of Ontario. He departed for Canada on Oct. 11 to examine properties at Ville Marie, Quebec; in Williamson Township, on the transcontinental railroad; lead and zinc properties in the Larder Lake area of Ontario, and copper deposits in Desmeloizes Township, Quebec. He expects to be engaged in this work for about six weeks.

OBITUARY

FREDERICK G. COGGIN, mining engineer and developer of Calumet & Hecla copper range, in northern Michigan, died in Chicago on Oct. 4. He was fifty-five years old.

HUGH FARNCOMBE, mining engineer, was killed recently in a mining accident in Chile. Mr. Farncombe was a son of Dr. T. S. Farncombe, and a graduate of Toronto University.

HENRY C. NEWTON, of Denver, seventy-four, formerly a writer of mining news and comment, was found dead in his cabin at Lake Eldorado, Colo., on Sept. 29. Mr. Newton was said to be a graduate of Yale. His father survives him and is 101 years of age, the oldest living Mason in Missouri, the Newton home being in Springfield.

Financial News

American Smelting & Refining Co. Earns $6,757,944 in First Half of Year

EARNINGS of the American Smelting & Refining Co. at the rate of $22.16 per share of common stock for 1927 are indicated in the semi-annual report of the company recently issued to stockholders. The report shows earnings of $6,757,944.38, or $11.08 per share, on the common stock for the six months' period ending June 30. These earnings are after all deductions for bond interest, depreciation, obsolescence, ore depletion, taxes, and preferred dividends. During the same period of 1926 earnings on the common stock were at the rate of $11.65 and in 1925 at the rate of $7.59. Net income of the company before dividends amounted to $8,507,944.38 for the six months' period. This compares with $8,854,855.45 for the first half of 1926. Surplus income for the period, after deducting dividends, amounted to $4,318,024.38. President Simon Guggenheim points out in his report that total current and miscellaneous assets made a gain during the period of $4,211,527.45, and amount to $101,336,684.48, which is more than five times the total current and miscellaneous liabilities of $20,019,347.22. Cash on hand at the end of the period, in the form of call and time loans and U. S. Government securities, amounted to $34,972,927.89. This is an increase of $452,143.69 over the same items at Dec. 31, 1926.

The position of the company on June 30 of this year, as compared with its position at the same time in 1926, is shown by the figures in the following table:

	Six Months Ended June 30, 1927	Six Months Ended June 30, 1926
Net earnings operating properties	$13,796,756.56	$14,346,277.12
Other income	1,011,686.03	740,621.47
Net earnings before expenses, taxes, and other charges	$14,808,442.59	$15,086,898.59
Less		
Administration expenses	827,226.88	$787,732.17
Corporate taxes	1,258,294.54	1,212,161.96
Interest	1,260,021.97	1,288,386.56
Depreciation and obsolescence	2,110,270.26	2,016,508.85
Ore depletion	844,684.56	927,253.60
	$6,300,498.21	$6,232,043.14
Net income	$8,507,944.38	$8,854,855.45

Dividends paid on the common stock for the period exceeded by $304,990 the amount paid in the first half of 1926. Total dividends paid were $1,750,000 on the preferred stock and $2,439,920 on the common.

STATISTICAL NOTES

VIPOND CONSOLIDATED MINES, LTD., show a balance of income over expenditure of $159,584 for the year 1927. The operating account, as it appears in the annual report now in the hands of shareholders, is given below:

Expenditure

Development	$75,772
Mining, including hoisting	244,331
Crushing, conveying and milling	127,856
Shipping and marketing bullion	6,018
General camp maintenance	10,531
Administration and general expense, mine	28,604
Administration and general expense, Toronto office	7,148
Transfer and directors' fees	19,446
Insurance, including special compensation assessments	27,222
Provincial and municipal taxes	5,013
Balance carried down	159,584
Total	$711,529
Ore milled, tons	95,799
Average value per ton	$8.21
Bullion recovered	704,899

Revenue

Bullion proceeds, less exchange	$704,889
Bond and bank interest earned	5,990
Miscellaneous recoveries	638
Total	$711,529

CONIAURUM MINES, of Porcupine, will make a bond issue of $800,000 bearing interest at the rate of 7 per cent. The issue was authorized at a meeting of the shareholders, held recently. This issue will be offered to all shareholders pro rata to their stock and in addition they will receive 80,000 shares as a bonus. Each shareholder owning 100 shares will have the opportunity of subscribing for a bond of $80 and will receive therefore eight shares of stock. The money when raised will be used in mill construction.

CHILE COPPER reports that during the six months ended June 30, 1927, the company treated 4,299,213 tons of ore averaging 1.565 per cent copper. Production for the six months was 111,554,553 lb., a monthly average of 18,592,426 lb. The production was 15,775,164 lb. less than the sales for the period.

The financial outcome of the Chile Copper Co. and Chile Exploration Co., combined, based on copper sales, shows for the six months as follows:

Total pounds sold	127,329,717
Total gross receipts	$16,986,088
After deducting all expenses and charges, including depreciation, amortized discount on bonds, accrued income tax and accrued bond interest, there remained a surplus of	$5,590,114

The two companies had available at Aug. 31, 1927, $3,614,067.24, cash and call loans, as against $4,623,046.51 on May 31, 1927.

The plant extension program, which is responsible for the reduction in cash surplus, is about complete.

CHILEAN COPPER EXPORTS during the second quarter of 1927 from the Antofagasta district to Europe were 19,118 tons, exceeding those to the United States, which amounted to 16,956 tons. The changed proportion was caused by heavy buying from Germany and France, which took 12,175 and 4,327 tons respectively. Exports during the first quarter of the year totaled 27,791 tons.

Coeur d'Alene Mines Make Good Showing Despite Lower Metal Prices

In spite of unsatisfactory metal prices during the year, especially in the case of lead, mining companies of the Coeur d'Alene district, Idaho, have made good profits during the first three quarters of 1927. The Bunker Hill & Sullivan Co. and the Federal Mining & Smelting Co. have maintained their usual dividend disbursements, the former at 75c. per share monthly and the latter at $1.75 per share quarterly on preferred stock. The Hecla Mining Co., which in 1926 paid 50c. per share quarterly, reduced its rate to 25c. this year, this action being taken on account of the large outlay being made in conjunction with the Bunker Hill & Sullivan in the construction of the electrolytic zinc plant. In addition to these larger companies, two new dividend payers entered the list this year, the Sidney Mining Co. and the Sunshine Mining Co. The former has paid two dividends of 1c. each and the latter two of 2c. each. The dividend disbursements for nine months this year are as follows:

Bunker Hill & Sullivan	$2,207,250
Hecla	750,000
Federal	630,000
Sunshine	60,000
Sidney	30,000
Douglas	15,000
	$3,692,250

Kerr Lake, Ltd., Paid $111,000 in Last Fiscal Year

KERR LAKE MINES, LTD., reports that at the Cobalt, Ontario, property there were obtained from No. 3 dump and a general clean-up of the floors of No. 7 rock house 14,509 lb. of concentrates, estimated to contain 14,972 oz. of silver. During the year 45,589 lb. of cobalt ore was sold. No development work was done at the property. The Tahoe silver property has remained idle.

Gold-dredging operations at the Rimu property, in New Zealand, produced 11,828 oz. of gold during the calendar year 1926, and for the first eight months of 1927 the recovery has amounted to 8,000 oz. of gold.

The total amount distributed to shareholders by the company to Aug. 31, 1927, is $10,371,000. Income and expenditure account for year ended Aug. 31, 1927, shows a surplus of revenue, over operating expenses, of $142,882. Of this sum $111,000 was distributed to shareholders, leaving $31,882 to be carried forward.

The Market Report

Metal Markets Mark Time—Little Change in Prices During the Week

New York, Oct. 12, 1927—Developments in the non-ferrous metal markets during the week have been unimportant. Zinc prices are a little higher, and tin is a little easier. Lead and copper are virtually unchanged. Copper and zinc both have been quiet, this being attributable in the case of zinc to a very active week just preceding. As for copper, this is the third successive dull week. Lead has been bought in good volume, and consumers likewise have been in the tin market for fair amounts of metal. Quicksilver has taken another sharp jump, and antimony prices are perceptibly firmer.

Copper Still Dull

Copper buying in large volume that producers have been expecting to develop has not begun yet, the last week being the smallest in point of tonnage sold for two months at least. Only two sellers did business under 13.25c. delivered in Connecticut, but the tonnage at lower figures exceeded that at the even quarter by a good margin. On Thursday several good sales were made at 13.125c., but since then the lowest price has been 13.15; and 13.175c. was the ruling figure yesterday, the last day of the *E. & M. J.* week for the New York markets because of the holiday on Oct. 12. At the same time sales have been made each day during the week at 13.25c., particularly on the last few days. Business in Europe has been quite satisfactory at the Exporters' price of 13.50c. Statistics of the A.B.M.S. just released show a further decline of 7,000 tons in refined stocks in North and South America for September.

Daily Prices of Metals

Oct.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
6	12.90	57.375	58.50	6.25	6.00	6.025
7	12.90	57.75	58.625	6.25	6.00	6.05
8	12.95	57.75	58.625	6.25	6.00	6.05
10	12.95	57.625	58.25	6.25	6.00	6.05
11	12.95	57.125	58.00	6.25	6.00	6.075
12	Holiday	.....	.....	....	6.00	6.075
	12.930	57.525	58.400	6.250	6.000	6.054

Average prices for calendar week ending Oct. 8, 1927, are: Copper, 12.915; 99 per cent tin, 57.896; Straits, 58.875; N. Y. lead, 6.250; St. Louis lead, 6.002; zinc, 6.025; and silver, 55.646.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
6	53 3/4	54	61 3/4	264 1/2	262	20 1/16	20 1/16	26 7/16	26 5/16
7	53 13/16	54 1/16	61 3/4	266 3/4	264	20 1/8	20 3/4	26 1/2	26 5/16
10	54 1/16	54 5/16	62	266 1/4	264 1/8	20 1/8	20 3/4	26 1/2	26 5/16
11	54 3/8	54 9/16	62 1/4	262 1/4	260	20 3/16	20 7/8	27 1/16	26 3/4
12	54 3/4	54 15/16	62 1/4	261 3/4	259 5/8	20 1/2	21 1/16	27 3/8	27

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver		Gold London	Oct.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
6	4.86 5/16	55 1/2	25 5/8	84s11 1/2d	10	4.86 1/2	55 7/8	25 13/16	84s11 1/2d
7	4.86 5/16	55 5/8	25 11/16	84s11 1/2d	11	4.86 3/4	55 3/4	25 11/16	84s11 1/2d
8	4.86 1/2	55 7/8	25 3/4	.....	12	Holiday	...	25 3/4	84s11 1/2d
					Avg.		55.725		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Lead in Better Demand

Most sellers sold satisfactory tonnages of lead during the last week, that metal being in considerably better demand than copper. Prices were unchanged, practically all sales being made on the basis of 6c., St. Louis, or 6.25c., New York, the last named quotation also continuing as the contract price of the American Smelting & Refining Co. Desilverized lead in the Middle West, however, has sold nearer to a 6.05c. St. Louis basis. Though the London price on prompt lead declined to a new low figure of £20 1s. 3d. last Thursday, the market since then has turned stronger, so that today's price is somewhat above that of last Wednesday. This is encouraging, as it was felt that a further decline in London, below, say £20, could not but affect the American quotations adversely. With current quotations it is almost possible to import bullion lead at a profit; in fact, it is not unlikely that some domestic sales have been based on foreign bullion supplies.

Corroders continue to take good tonnages of lead, and a fair amount has been sold to ammunition makers in the last week. The demand continues largely for prompt shipment, with but little interest yet exhibited in November.

Zinc Prices Firmer

The buying of zinc that materialized in such large volume when the price sagged to 6c. last week subsided as prices were advanced. Nevertheless, a fair business was done and prices seem firm at 6.075c. today, with still more being realized on occasional lots. The principal buyers of slab zinc during the week have been brass melters, the galvanizers apparently having supplied themselves for the time being during the preceding week. High-grade is still nominally at 8c. for spot lots. Figures issued by the American Zinc Institute in tons of 2,000 lb. show the September position as follows:

Stock, Sept. 1	34,587
Produced	47,735
Shipped	48,045
Stock, Sept. 30	34,277

Shipped from plant for export..	4,007
Metal sold, undelivered, Sept. 30	14,749
Retort capacity, Sept. 30	131,484
Average retorts operating	74,051
Retorts operating Sept. 30	74,435

Lower Tin Prices Attract

The tin market was largely a routine affair until Tuesday, when lower prices in London brought offerings here as low as 57.75c. for prompt Straits tin. Consumers then entered the market and quickly pushed the price up to 58c., at which level an appreciable tonnage was sold. Tin for shipment from the Straits has averaged about a half-cent less than prompt, and 99 per cent has been available for from ¾ to 1c. below the Straits quotation.

Sterling Exchange Strong

Sterling exchange continued to advance toward the gold shipment point, going well above $4.87 for cable transfers. Other European exchanges were firm. Closing cable quotations on Tuesday, Oct. 11, were: francs, 3.92⅞c.; lire, 5.46¾c., and marks, 23.855c. Canadian dollars, ¾ per cent premium.

Silver Steady

During the past week the silver market fluctuated within narrow limits and is quoted steady at the present level.

Buying for China account is the supporting feature of the market while Indian rates are slightly under New York prices.

MEXICAN DOLLARS (Old Mexican pesos): Oct. 6th, 42c.; 7th, 42⅛c.; 8th and 10th, 42⅜c.; 11th, 42¼c.; 12th, holiday.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 98 or 99 per cent grade, price of leading interest, 26c.; outside market, 25.30@25.80c.

ANTIMONY—Per lb., duty paid. New York: Chinese brands, spot business, 11⅜c. Market weak. Cookson's "C" grade, spot, 17¾c. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, 16½c.

BISMUTH—Per lb., New York, in ton lots, $1.85@$2.10. London, 8s.

IRIDIUM—Per oz., $106@$110 for 98 @99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade) for single lots of spot metal.

PALLADIUM—Per oz., $53@$54. Small lots bring up to $58. Market dead and prices nominal. Pure metal as a constituent of crude platinum, nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $72. Dealers and refiners quote the trade for refined metal, per oz., cash, $64.50@$66. Market more active.

QUICKSILVER—Per 76-lb. flask, range for week $126@128, depending on quantity. San Francisco wires $124.67. London, £21¾@£22 by mail. Now probably higher.

Prices of Cadmium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Oct. 8.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn. c.i.f. North Atlantic ports, minimum 47 per cent Mn, 36@38c. Caucasian, washed, 53@55 per cent, 40c. Chemical grades unchanged from quotations in the Oct. 8 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $10@$10.25. Western scheelite, $10.25@$10.50. Market dull.

Chrome, Iron, Molybdenum, Tantalum, Titanium, Uranium, and Vanadium Ores are unchanged from quotations in the Oct. 8 issue.

Joplin Ore Market Unchanged

Joplin, Mo., Oct. 8, 1927

	Per Ton
Blende	
High	$42.50
Premium blende, basis 60 per cent zinc	$39.00@ 40.00
Prime Western, basis 60 per cent zinc	38.00
Fines and slimes, 60 per cent zinc	34.00@ 37.00
Average settling price, all grades	40.44
Galena	
High	$83.90
Basis 80 per cent lead	80.00
Average settling price, all lead	81.96

Shipments for the week: Blende 12,892; lead, 1,418 tons. Value, all ores the week, $637,580.

The American Metal Co. is again in the market for zinc flotation concentrates, of which more than 2,500 tons was purchased this week. The total purchase of the week was 18,110 tons. There is still a strong tendency on the part of some producers to withhold lead concentrates from the market, though others are selling more freely. Some operators, where it is possible, are mining the lead ore and holding the zinc in reserve in the ground.

Platteville, Wis., Oct. 8, 1927

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$40
Lead Ore	
Lead, basis 80 per cent lead	$80

Shipments for the week: Blende, 1,050 tons; lead, 115 tons. Shipment for the year: Blende, 51,479; lead, 1,405 tons. Shipment for the week to separating plants, 2,004 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the Oct. 8 issue.

Mineral Products

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Market slack. London, Cornish white, per long ton, £18@£18¼.

Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Oct. 8 issue.

Ferro-Alloys

FERROMANGANESE—Per long ton, domestic and foreign, 78@82 per cent, $90, f.o.b. furnace, for delivery during second half 1927. Spiegeleisen, 19@21 per cent, $33@$35 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 93@96c. f.o.b. works. Dull.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, and Ferrovanadium are unchanged from prices in the Oct. 8 issue.

Metal Products

ROLLED COPPER—Per lb., f.o.b. mill, sheets, 22c.; wire, 15½c.

LEAD SHEETS—Full rolled 9¾c.; clipped 10c. per lb.

Nickel Silver, Yellow Metal, and Zinc Sheets unchanged from prices in Oct. 8 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the Oct. 8 issue.

Iron and Steel Production Drops

Pittsburgh, Oct. 11, 1927.

September production of steel ingots, all classes, was approximately 3,256,000 tons, representing 3.3 per cent decrease from August and 16.8 per cent decrease from September, 1926. The industry is operating at about 65 per cent. The steel corporation's unfilled obligations decreased 47,924 tons in September, after three months of small increases. Shipments decreased from 71 per cent of capacity in August to 68 per cent in September, and thus there was a substantial decrease in bookings.

Price cutting of $2 a ton on all descriptions of sheets is now generally recognized, but leaves the market above the level of last April, before the ambitious advance was attempted.

Pig Iron—The Valley pig-iron market remains very dull, buying being in small lots. Shipments, however, are at close to the production, which is greatly restricted. Prices are moderately steady and unchanged at $18 for bessemer, $17 for basic, and $17.50 for foundry.

Connellsville Coke—The spot market is off at $2.65@$2.75 for heating and $2.85@$3.00 for furnace coke, foundry coke being nominally unchanged at $4.00@$4.75.

Review of Current Statistics

THE general dullness which was a feature of the metal markets during September is reflected in a recession of the index figure from 97.25 to 96.01. Lead is mainly responsible for this fall, although copper, zinc, and tin all contributed to the lowering of the index, silver being the only metal to rise in price during the month. The optimism freely expressed during August as to the volume of buying to be expected in the early fall has not yet proved justified.

Turning to metal statistics, domestic production of refined copper in August was slightly higher than during July, but was still well below the January to May levels. World production, however, showed a bigger increase over the July figures and was influenced by larger outputs from South Africa and South America owing to increased outputs by Union Minière and the incipient activity of the Andes Copper Co. The figure of 347,072 tons for stocks of blister and refined gives room for encouragement, being a low point for the year. The price, as generally quoted by most sellers, remained firm at 13¼c. This meant that the market was almost monopolized by one or two sellers whose policy is to sell their output regardless of the general condition of the market. It seems probable that demand will soon be more than equal to the supply from these sources, and although it would be unwise to predict that the 13¼c. price will not be undercut during the last half of October, there seems every indication of a more robust tone prevailing in the copper market. Export business in copper has been an encouraging feature of September markets, and it will be observed in this connection that foreign shipments of copper during August increased considerably. Although they declined somewhat in September the figure still remains above the level of the early part of the year.

The low prices quoted for lead should make price no stumbling block so far as consumers are concerned, but unless a buying wave of quite unusual vigor manifests itself during October, there will probably be no great change in quotations. It will be noticed that although imports of lead declined, compared with the July figure, they remain relatively high in comparison with the records for preceding months of the year.

Low stocks are a feature of the zinc statistics. On July 1 stocks were 43,858 tons; at the end of August they had declined to 34,587, a highly satisfactory decrease. Data for September, just released, show a further slight decrease to 34,277 tons on Sept. 30, production in September being 8½ per cent less than in September, 1926, and shipments 12 per cent less than a year ago.

The June world silver production figures have just become available and show a heavy increase in production, the figure standing at 626,000 oz. per day.

Prices of non-metallics remain fairly steady, but a small fall in feldspar prices caused a slight depression of the index figure.

In spite of the lower metal prices prevailing, the market in mining stocks, as in other securities, remained buoyant. The weighted index of valuation of seven mining, smelting, and manufacturing companies climbed to over 170 as a result of considerable appreciations in the market value of Anaconda and International Nickel shares, as against only negligible declines in the values attached to the stock of New Jersey Zinc, U. S. Smelting, and American Metal. In the domain of copper stocks, the *E. & M. J.* index for September is 117.6, against 112.6 for August. Here, however, the public's estimates of the various shares is more variable: Inspiration, Chile Copper, and Granby all declined in value, but very considerable appreciation took place in the shares of United Verde Extension, Calumet & Arizona, and Kennecott. Kennecott is now quoted at over $74 and Calumet & Arizona shares have risen to over $84 as a result of important ore discoveries reported from the property.

Little change is noticeable in the gold-silver-lead-zinc group. Hollinger and St. Joseph Lead have declined, but the rise in the value of Lake Shore Mines stock has counteracted this as far as the effect on the index is concerned. The drop in lead prices is doubtless responsible for small declines in Tintic Standard and Federal Mining & Smelting.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74

	1925	1926	1927
March	110.20	108.95	100.84
April	104.75	105.93	98.63
May	105.34	105.43	96.41
June	107.19	106.68	95.55
July	108.81	109.08	95.42
August	113.61	110.22	97.25
September	114.66	109.27	96.01
Average first nine months	110.49	108.90	97.84

THE tables given below show the comparative indices of world production and the prices of the major non-ferrous metals. These tables are taken from the Metallgesellschafts Statistics for 1926. The large increase in the production of aluminum is the outstanding feature of the world production figures: the 1926 output was no less than 400 per cent of the 1913 production. It will be seen that lead alone among the metals has had any conspicuous increase in price, if copper prices during the war period be excepted. Lead prices in 1925 were 200 per cent above the 1913 level, and although the subsequent years witnessed a considerable decline, the average price for the first half of the current year is more than 60 per cent higher than 1913 average, a rise which is not even eclipsed by the increase in the price of tin.

The third table shows the world production of aluminum: this has been segregated to show the output of the most important producing countries. It will be noticed that Germany's production has been increasing rapidly. Germany has outstripped Norway, but the Norwegian production remains extremely important and is, of course, a reflection of the large resources of cheap water power.

Index of Metal Prices in New York

Year	Aluminum	Lead	Copper	Zinc	Tin
1909–13	100	100	100	100	100
1913	107	99	110	96	113
1914–18	181	144	157	165	135
1919–23	116	142	110	109	109
1924–26	123	194	98	121	144
1924	123	184	93	108	126
1925	124	205	101	130	145
1926	123	191	99	125	162
Half year 1927	117	162	92	110	167

Index of World Production

(1909-1913 = 100)

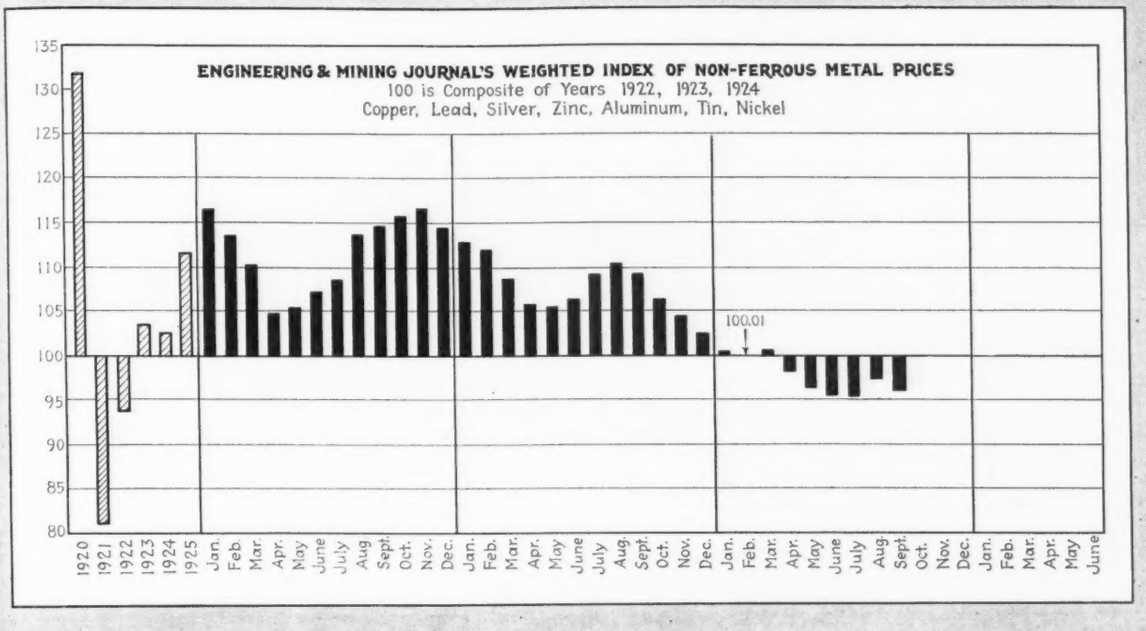
Year	Aluminum	Lead	Copper	Zinc	Tin
1909–13	100	100	100	100	100
1913	132	104	108	112	110
1914–18	249	102	136	102	106
1919–23	227	84	97	77	99
1924–26	374	128	149	126	118
1924	342	112	144	113	113
1925	378	132	149	127	121
1926	403	139	155	138	119

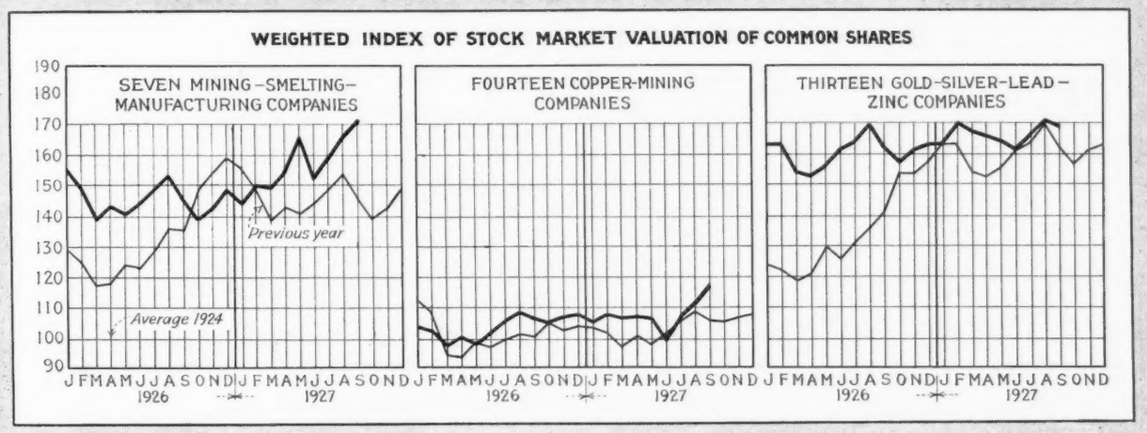
Production of Aluminum

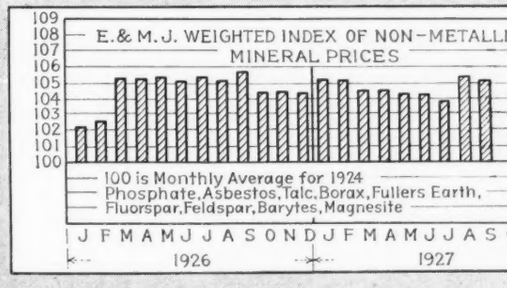
(In thousands of metric tons)

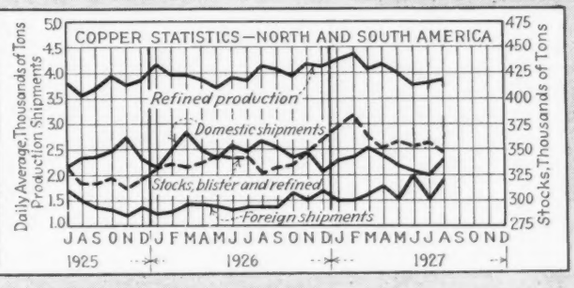
	1913	1920	1921	1922	1923	1924	1925	1926
France	14.5	12.3	8.4	7.5	14.3	18.5	20.0	21.0
Switzerland	10.0	12.0	12.0	13.0	15.0	20.0	22.0	22.0
Germany	1.0	10.9	10.0	15.0	15.9	18.7	26.2	29.6
Austria	3.0	2.0	2.0	2.0	1.5	2.2	3.0	3.0
England	7.6	8.0	5.0	5.0	8.0	7.0	9.7	7.3
Norway	1.5	5.6	4.0	4.9	13.3	20.0	21.3	22.0
Italy	0.8	1.7	0.7	0.8	1.5	2.1	1.9	1.8
Europe	38.4	52.5	42.1	48.2	69.5	88.5	104.1	106.7
United States	20.9	62.6	24.5	33.6	58.5	68.3	68.0	75.0
Canada	5.9	12.0	8.0	10.0	10.0	12.5	15.0	18.0
America	26.8	74.6	32.5	43.6	68.5	80.8	83.0	93.0
Totals	65.2	127.1	74.6	91.8	138.0	169.3	187.1	199.7

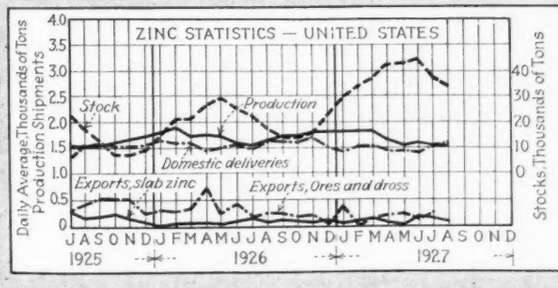
E.&M.J. Statistics of the Mining Industries

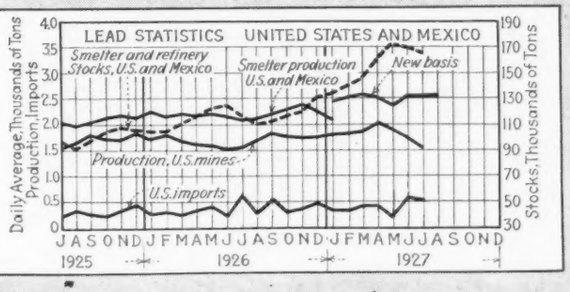

ENGINEERING & MINING JOURNAL'S WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is Composite of Years 1922, 1923, 1924
Copper, Lead, Silver, Zinc, Aluminum, Tin, Nickel
100.01
1920 1921 1922 1923 1924 1925 Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June


WEIGHTED INDEX OF STOCK MARKET VALUATION OF COMMON SHARES
SEVEN MINING–SMELTING–MANUFACTURING COMPANIES
Previous year
Average 1924
FOURTEEN COPPER-MINING COMPANIES
THIRTEEN GOLD-SILVER-LEAD–ZINC COMPANIES
J F M A M J J A S O N D J F M A M J J A S O N D
1926
1927

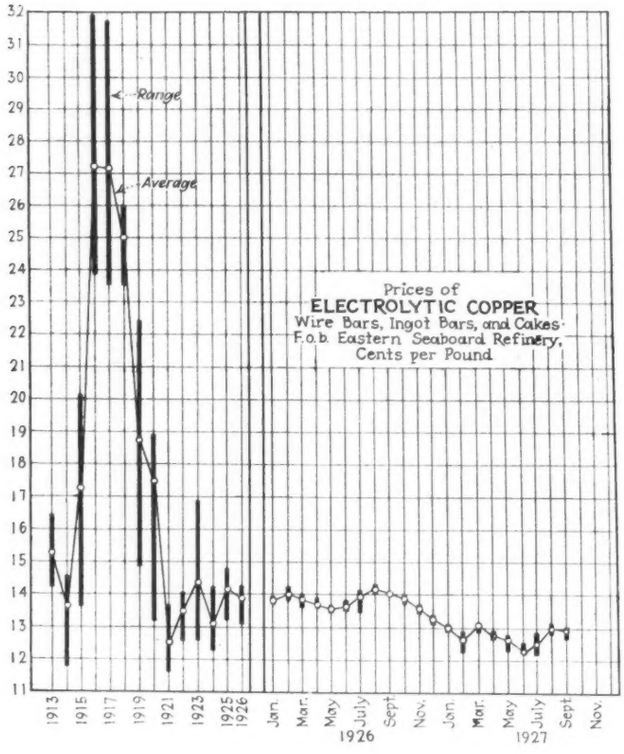

E.& M.J. WEIGHTED INDEX OF NON-METALLIC MINERAL PRICES
100 is Monthly Average for 1924
Phosphate, Asbestos, Talc, Borax, Fullers Earth, Fluorspar, Feldspar, Barytes, Magnesite
J F M A M J J A S O N D J F M A M J J A S O N D
1926
1927

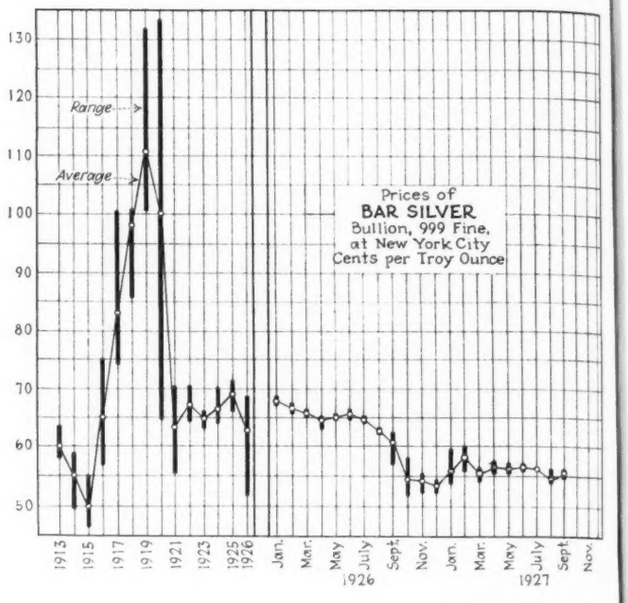

COPPER STATISTICS—NORTH AND SOUTH AMERICA
Daily Average, Thousands of Tons Production Shipments
Stocks, Thousands of Tons
Refined production
Domestic shipments
Stocks, blister and refined
Foreign shipments
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1925
1926
1927

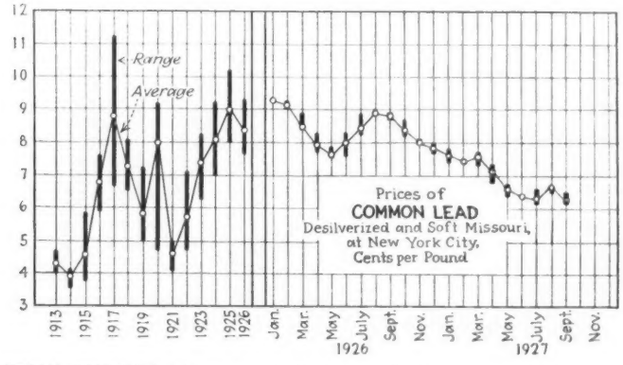

ZINC STATISTICS — UNITED STATES
Daily Average, Thousands of Tons Production Shipments
Stocks, Thousands of Tons
Stock
Production
Domestic deliveries
Exports, slab zinc
Exports, Ores and dross
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1925
1926
1927

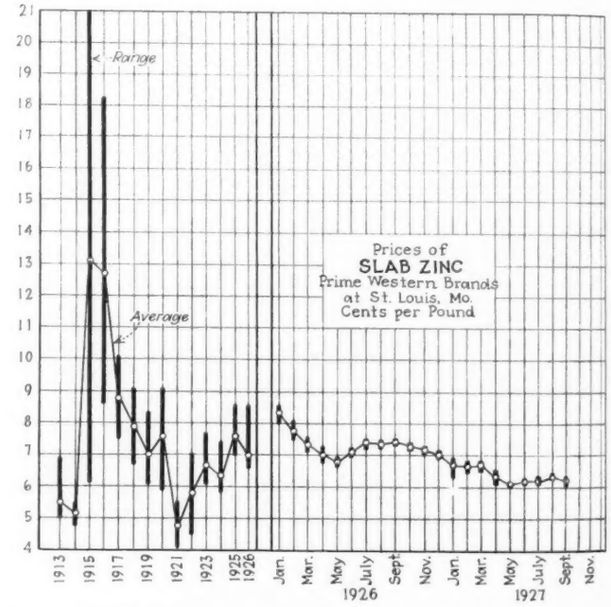

LEAD STATISTICS UNITED STATES AND MEXICO
Daily Average, Thousands of Tons Production, Imports
Stocks, Thousands of Tons
Smelter and refinery Stocks, U.S. and Mexico
Smelter production U.S. and Mexico
New basis
Production, U.S. mines
U.S. imports
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1925
1926
1927

Metal Price Curves

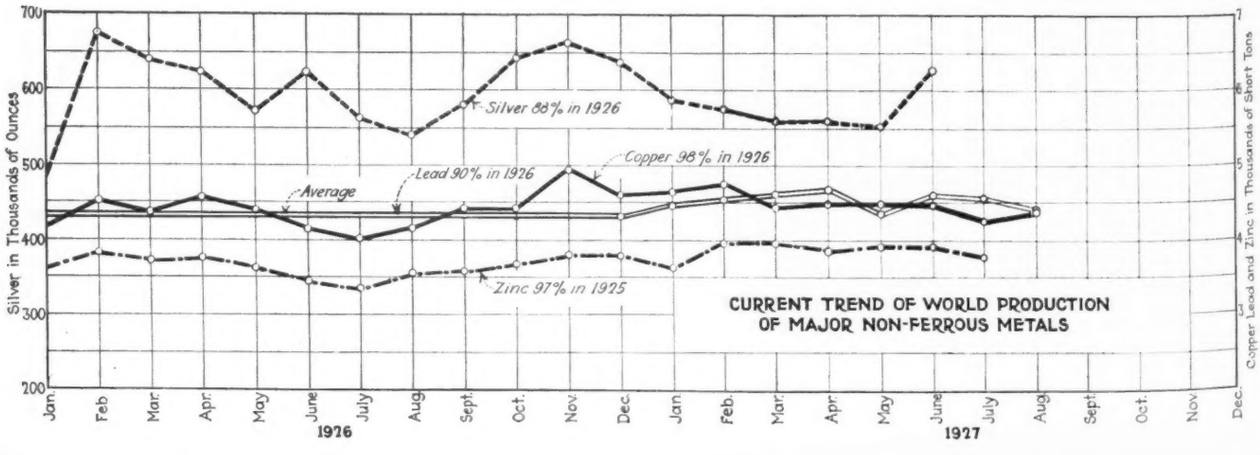








THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926; and accordingly a horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.



Mining Stocks—Week Ended October 8, 1927

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	49	47⅛	48⅛	Oc.15, No.21 Q	0.75
Arcadian Consol.	Boston	*55	*55	*55		
Ariz. Com'l.	Boston	6⅛	5⅞	6	Jy. 18, Jy. 30	0.25
Calaveras	N. Y. Curb			1⅜		
Calumet & Arizona	New York	89⅜	84⅛	86	Se. 9, Se. 26 Q	1.50
Calumet & Hecla	Boston	17⅛	16⅛	16⅜	Au. 31, Se.15 Q	0.50
Cerro de Pasco	New York	66⅛	64⅛	65	Oc.13, No.1 Q	1.00
Chile Copper	New York	36	35⅛	35⅛	Se. 2, Se. 30, Q	0.62½
Con. Coppermines	N. Y. Curb	3⅛	3	3⅛		
Copper Range	Boston	17	15⅛	15⅜	Ap.2, My.2, A	1.00
Crystal Copper	BostonCurb	*30	*28	*29		
East Butte	Boston	1⅜	1⅛	1⅛	Dec., 1919	0.50
Granby Consol.	New York	36	34⅜	34⅜	Jn.15 Jy. 1 Q	1.00
Greene Cananea	New York	84⅜	76	77⅛	Nov., 1920	0.50
Howe Sound	New York	39⅝	38⅛	38⅜	Oc.1, Oc.15, Q	1.00
Inspiration Consol.	New York	18⅛	16⅜	18⅛	Ma.17, Ap.4, Q	0.25
Iron Cap	Boston Curb	1⅞	1⅝	1⅞		
Isle Royale	Boston	12⅜	12	12⅜	Se. 30, Oc. 15, Q	0.50
Kennecott	New York	76½	73½	75⅜	Se. 2, Oc. 1, Q	1.25
Magma Copper	New York	48⅜	43	46½	Se.30,Oc.15 Q	0.75
Mason Valley	N. Y. Curb	*88	*86	*86		
Miami Copper	New York	15¼	14⅞	15⅛	No.1, No.15, Q	0.37½
Mohawk	Boston	47	45½	45½	Jy.30, Se.1 Q	1.00
Mother Lode Coal	New York	2	1⅜	2	Jn.10, Jn.30	0.25
Nevada Consol.	New York	17	16⅛	16⅛	Se. 16, Se. 30 Q	0.37½
New Cornelia	Boston	23⅛	22	22⅜	Au.5, Au.22 Q	0.50
Noranda	N. Y. Curb	28¾	26¾	26¾		
North Butte	Boston	1¼	1⅛	1⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*99	*86	*94	Sept. 1926	0.03
Old Dominion	Boston	12½	12⅛	12⅛	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	†122	†118	....	Se.21, Oc.1 Q	1.50
Quincy	Boston	17⅛	15	17	March, 1920	1.00
Ray Consolidated	New York	....	....	15⅛	Ap.20, Ap. 30	0.25
St. Mary's Min. Ld.	Boston	27	21⅛	25⅞	Fe.10, Ma.10	2.00
Seneca Copper	New York	1⅜	1⅛	1⅛		
Shattuck Denn	Boston Curb	6	5	5⅜		
Tenn. C. & C.	New York	8⅞	8⅜	8⅜	Au.31,Se.15, Q	0.12½
United Verde Ex.	N. Y. Curb	30	26¼	27	Oc.6, No.1 Q	0.75
Utah Copper	New York	....	....	130	Se. 16, Se. 30 Q	1.50
Utah Metal & T	Boston	1 1/16	1	1 1/16	Dec., 1917	0.30
Walker Mining	Salt Lake	*47	*44½	*45		
NICKEL-COPPER						
Internat. Nickel	New York	70⅞	67	67⅜	Se. 16, Se. 30 Q	0.50
Internat. Nickel pfd.	New York	....	....	109	Oc. 13, No. 1 Q	1.50
LEAD						
Gladstone Mtn.	Spokane	*15	*14½	*14½	June, 1927	0.005
National Lead	New York	125½	120¼	120⅞	Se. 16, Se. 30 Q	1.25
National Lead pfd.	New York	112	111	112	Se.1, Se. 30 Q	1.75
St. Joseph Lead	New York	38	37¼	37¼	De.10,De.20,QX	0.75
ZINC						
Am. Z. L. & S.	New York	6¼	6	6	May, 1917	1.00
Am. Z. L. & S. pfd.	New York	37	36	37	Nov., 1920	1.50
Butte C. & Z.	New York	4⅛	4	4	De. 9, De. 24	0.50
Butte & Superior	New York	8⅞	8⅛	8⅜	Se. 16, Se. 30 Q	0.50
Callahan Zn-Ld.	New York	1⅜	1⅛	1⅛	Dec., 1920	0.50
Consol Lead&Zinc'A'	St. Louis	12	12	12	Ma.15, Ap.1 Q	0.25
Eagle-Picher	Cincinnati	25	24⅜	24⅞	No.15, De.1 Q	0.40
Eagle-Picher pfd.	Cincinnati			117½	Jn.30, Oc.15 Q	1.50
New Jersey Zn.	N. Y. Curb	188	186	187	Jy.20, Au.10 QX	2.00
United Zinc	N. Y. Curb	...	...	*55		
Yellow Pine	Los Angeles	...	...	*37½	Dec. 1925 Q	0.04
GOLD						
Alaska Juneau	New York	1⅜	1⅛	1⅜		
Argonaut	Toronto	*50	*40	*42		
Barry-Hollinger	Toronto	*99	*80	*91		
Con.W.Dome L.new.	Toronto	*18½	*10½	*17		
Cresson Consol. G.	N. Y. Curb	2	2	2	Se. 30, Oc.10 Q	0.10
Dome Mines	New York	11½	10½	10½	Se.30, Oc.20 Q	0.75
Golden Cycle	Colo.Springs	†1.79	†1.77½		Au.30, Se.10 Q	0.04
Hollinger Consol.	Toronto	17.50	16.75	17.45	Se. 21, Oc. 7 F	0.10
Homestake Mining	New York	66	65	66	Oc.20, Oc. 25 M	0.50
Kirkland Lake	Toronto	2.80	2.55	2.59		
Lake Shore	Toronto	28.20	27.00	27.00	Se.1, Se.15 X	0.20
McIntyre-Porcupine	New York	28⅜	28	28	Au.1, Se.1 Q	0.25
Portland	Colo.Springs	†*25	†*20		Ap.6, Ap.15, Q	0.02
Rand Mines	New York			48½	Au.22-29 Am.£h.	1.52
Teck-Hughes	Toronto	11.35	10.25	10.30	Jy.21, Au.1	0.10
Tom Reed	Los Angeles	*45	*40	*45	Dec., 1926	0.02
Tough-Oakes	Toronto	*60	*37	*59		
United Eastern	N. Y. Curb	*45	*40	*45	July, 1924	0.05
Vipond Cons.	Toronto	*64	*50	*58	Apr.1, Apr.15	0.03
Wright-Hargreaves	Toronto	8.45	7.60	7.75	Jy.15, Au.1 SA	0.05
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	11⅞	11⅛	11⅛		
Con. Cortez	N. Y. Curb	*25	*24	*24		
Dolores Esperanza	N. Y. Curb	....	....	*58	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2 3/16	2 3/16	Se.15, Oc. 4	0.08
Tonopah Belmont	N. Y. Curb	1⅜	1⅛	1¼	Ma.15, Ap.4	0.08
Tonopah Extension	N. Y. Curb	....	....	*51	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	2⅛	2	2	Se.20, Oc.21	0.07½
West End Consol.	N. Y. Curb	...	...	*7	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	....	....	*44	June, 1918	0.02
SILVER						
Beaver Consol.	Toronto	2.01	1.85	1.87	May, 1920	0.03
Castle-Trethewey	Toronto	*81	*71	*75		
Coniagas	Toronto	5.00	4.70	4.95	May, 1924	0.12½
Keeley	Toronto	*78	*75	*75	Se.1, Se.15	0.08
Lorrain Trout Lake	Toronto	*60	*60	*60	July, 1925	0.05
McKinley-Dar.-Sav.	Toronto	*17½	*16	*16	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.60	3.20	3.50	Jn. 29, Jy.15	0.12½
Nipissing	N. Y. Curb	7⅛	6	6⅝	Se.30, Oc.20 Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	4⅛	3⅛	3⅛	Ma. 25,Ap.4,QX	0.12½
Bingham Mines	Boston	60⅛	58⅛	60	Se.24, Oc.5 Q	1.00
BunkerHill&Sullivan	N. Y. Curb	150	140⅛	148½	Jy. 30, Au.4 X	0.75
Cardiff M. & M.	Salt Lake	†*40	†*35	....	Feb. 5, 1927	0.10
Chief Consol.	Salt Lake	2.20	2.20	2.20	Nov., 1926 Q	0.10
Consti'nMng.&Mill'g	Spokane	*20	*19	*20		
Erupcion	Boston Curb	*72	*65	*72	Se. 15, Oc.3 Q	0.07½
Eureka Lily	Salt Lake	1.15	1.12½	1.12½		
Federal M. & S.	New York	132	132	132	Jn.25, Jn.29 Spec.	$10
Federal M. & S pfd.	New York	93½	93½	93½	Au. 25, Se.15 Q	1.75
Hecla Mining	N. Y. Curb	17⅛	16	16⅝	Au. 15 Se 15 Q	0.25
Highland-Surprise	Spokane	*12	*11	*12		
Iron King Mining	Salt Lake	*50	*48	*50		
Keystone Mining	Salt Lake	†*21	†*18	....	Au. 12, Au. 26	0.07½
Lucky Jim	Spokane	*32	*27	*32		
Lucky Tiger-Com	Kansas City	†7.10	†6.85	....	Oc.10, Oc. 20	0.05
Mammoth Mining	Salt Lake	1.70	1.70	1.70	Jn.10, Jn.20 Q	0.05
Marsh Mines	Spokane	*75	*75	*75		
North Lily	Salt Lake	3.00	2.95	2.95		
Park Utah	New York	7⅛	7	7⅛	Se. 15, Oc. 1 Q	0.20
Plutus Mining	Salt Lake	1.70	1.65	1.70	Jy. 10, Jy. 15 Q	0.10
San Rafael	San Fran.	*7½	*7	*7½		
Silver King Coal	Salt Lake	9.00	8.70	9.00	Se. 20, Oc. 1 Q	0.25
Silversmith	Spokane	*17½	*16	*16	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*47	*46	*46		
Sunshine M. Co.	Spokane	1.30	1.25	1.25		
Tamarack-Custer	Spokane	*25	*23½	*23½	Sept., 1924	0.25
Tintic Standard	Salt Lake	12.12½	12.00	12.25	Se.15, Se.29 QX	0.40
Utah-Apex	Boston	5	4⅛	4⅜	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	62⅜	56⅛	57⅛	Se. 2, Oc. 1,	1.75
Cleveland-Clifis Iron	Cleveland	100	93	99½	Jy. 15, Jy. 25 Q	1.00
Colorado Fuel & Iron	New York	81⅜	76	77⅛	May, 1921	0.75
Gt. North'n Iron Ore	New York	28⅛	25⅞	26⅛	Dec. 6, Dec. 28	0.75
Inland Steel	New York	52⅜	51⅜	52	Au. 15, Se. 1 Q	0.62½
Replogle Steel	New York	....	....	12⅛		
Republic I. & S.	New York	65	63⅛	63⅛	Au. 15, Se. 1 Q	1.00
Republic I. & S. pfd.	New York	102	101⅜	101⅜	Se. 15, Oc. 1 Q	1.75
Sloss-Sheffield S. & I.	New York	....	....	126	Se. 10, Se. 20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	....	....	107	Se. 20, Oc. Q	1.75
U. S. Steel	New York	154⅝	145⅝	146⅛	Au. 30, Se. 29 Q	1.75
U. S. Steel, pfd.	New York	137	135½	136½	Au. 1, Au. 30 Q	1.75
Virginia I. C. & C.	New York	41	41	41	Jan., 1924	1.50
Virginia I.C.&C. pfd.	New York	....	....	60⅛	Ju. 15, Jy. 1	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol.	New York	...	...	27⅛	Jn. 26, Jn.30	1.45
So. Am. G. & P. New.	N. Y. Curb	3⅛	3⅛	3⅛		
Alum. Co. of Amer.	N. Y. Curb	99	96⅛	96⅛		
Alum. Co. of Amer.pf.	N. Y. Curb	104⅞	103½	104⅛	Se. 15, Oc 1 Q	1.50
Vanadium Corp.	New York	54⅛	52	52⅛	Au. 1, Au. 15 Q	0.75
Patino M. & E.	New York	21⅛	20⅜	21	Ap. 27, My. 5	1 sh.
ASBESTOS						
Asbestos Corp.	Montreal	37	33	35	Jan., 1926	1.50
Asbestos Corp. pfd.	Montreal	95½	94½	95	Se.30, Oc.15 Q	1.75
SULPHUR						
Freeport, Texas	New York	91	80½	89⅜	Oc.15, No.1 QX	1.50
Texas Gulf	New York	76¾	72⅛	76¼	Ju. 1, Ju. 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	42¼	41⅛	42	Au.20, Se.1 Q	0.75
Amer. Metal, pfd.	New York	....	....	110	Au.22, Se.1 Q	1.75
Amer. Sm. & Ref.	New York	174⅛	168½	168⅜	Oc.14, No. 1 Q	2.00
Amer. Sm. & Ref. pfd.	New York	131½	130⅛	130⅛	No., Dec. Q	1.75
Consol. M. & S.	Montreal	270	257	260	Jn. 30, Jy.15 X	6.25
Newmont Mining	N. Y. Curb	101	98⅛	99	Se.30, Oc.15 Q	1.00
U. S. Sm. R. & M.	New York	41	40	40	Oc. 6, Oc. 15 Q	0.87½
U.S. Sm. R.&M. pfd.	New York	51⅛	50	50	Oc. 6, Oc. 15 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED SEPT. 20, 1927 Last Div.

Name	High	Low	Last	Date	Amount
Aramayo Mines (25 frs.)	75/—	72/6	75/—	Aug., 1927	5 p.c. (†)
British Platinum (£1)	1/6	—/9	1/6	Feb., 1925	2½ p.c.
Burma Corpn. (10 rupees)	13 6	12/10½	13/—	Aug., 1927	6 annas*
Bwana M'Kubwa (5s)	5/—	4 6	4/9		
Camp Bird (2s)	3/4½	3/1½	3/4½		
El Oro (£1)	3/6	3/1½	3/4½	Nov., 1924	2½ p.c.*
Esperanza (10s)	—/2	—/1	—/1		
Frontino & Bolivia (£1)	14/4½	13/9	13 9	July, 1927	5 p.c.
Mexican Corpn. (£1)	7/7½	7/—	7 6		
Mexico Mines of El Oro (£1)	16/10½	15 —	15/—	Dec., 1926	3¾ p.c.*
N'Changa Copper Mining	10/—	7/6	9/—		
Oroville Dredging (£1)	5/9	5/—	5 9	Dec., 1923	2½ p.c.
Ouro Preto (£1)	2/6	2/—	2 6	May, 1925	2½ p.c.
Rhodesian Congo Border (£1)	42/3	38 6	41 —		
St. John del Rey (£1)	10/6	10 1½	10 6	May, 1927	3¾ p.c.
San Francisco Mines (10s)	27/9	27 3	27 6	July, 1927	15s.
Santa Gertrudis (£1)	16/6	15 9	16 3	July, 1927	7½ p.c.
Selukwe (2s. 6d.)	8/6	7/9	8/—	April, 1917	6¼ p.c.
S. Amer. Copper (2s.)	2/10½	2/4½	2/9	Nov., 1917	75 p.c.
Tanganyika (£1)	66/3	61/3	61 10½	Aug., 1927	7½ p.c.
Union Miniere du Haut-Katanga (Brussels)	10.800	10.025	10.075	July, 1927	182.60 (†)

* Free of British income tax. † Swiss francs and plus 15 p. c. bonus. ‡ Belgian frs. and free of taxation.

Industrial Progress

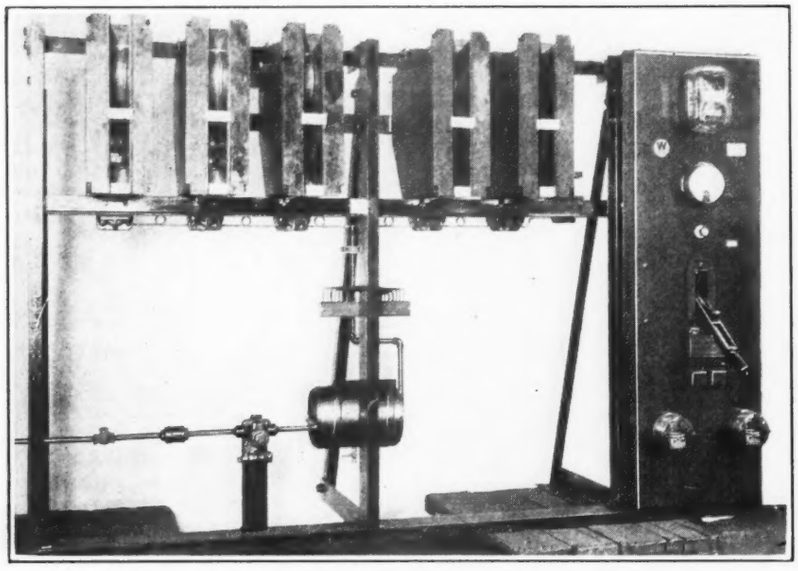


Fig. 1—Front view of full magnetic type control

Nevada Consolidated's Skip-Hoist Control

By E. S. Hoffman
Control Engineer, Westinghouse Electric and Manufacturing Co.

THE hoist of the Nevada Consolidated Copper Co. is of the vertical or 90-deg. type. Normally it will be balanced, but the present equipment is designed for unbalanced operation and continuous duty. A description of the control should therefore be of interest. The hoist is driven by a 900-hp., 440-volt, 3-phase, 60-cycle motor. The depth of the mine shaft is approximately 660 ft.; diameter of sheaves and drums 12 ft., and the diameter of cable $1\frac{3}{4}$ in. Cable speed is approximately 750 ft. per minute.

Control of the full magnetic type, with primary pneumatic reversing switches, is in use. Starting and stopping are manually controlled. The accelerating of the motor, with the exception of the first three points, is accomplished by means of a time-limit mechanism. The last six sets of acceleration are automatic, with an accelerating period of ten seconds. Hoist control is arranged for regenerative braking and consists essentially of an incoming line panel, a pneumatic reversing switch group, a secondary panel on the frame of which is also mounted an auxiliary panel for the control of the motor generator set, and an oil pump motor. A pulpit panel, Lilly hoist controller, Model "B," are also supplied. The main motor secondary is provided with an eight-step Class 72 resistor. Also provided are limit switches, a 20-S cam-operated, 8-point master switch, a drum backout switch, an emergency push button, and a foot-operated, maximum-torque push button.

Figs. 1 and 2 respectively show the front and rear views of this unit. This panel, 76 in. high by 24 in. wide, is made of sheet steel, and on it is mounted a watt-hour meter, an ammeter, one control switch, two over-current relays, and a cover plate for a manually operated, remote-control oil circuit breaker. The breaker unit now shown is mounted approximately 92 in. in the rear of the panel on a separate pipe frame, on which are mounted also the necessary voltage and current transformers.

The circuit breaker is provided with an under-voltage trip attachment and is arranged to trip the breaker at approximately 50 per cent of normal voltage or less. Two direct overload trip attachments are also provided, consisting of two retaining magnets mounted in the cover plate of breaker. The tripping mechanism consists of a series holding coil, and a secondary coil, the holding coils being in series with the trip coils and relay operating coils.

The trip mechanism is prevented from operating until after the contacts in the relay have closed, which shorts the secondary coil. The relay operates on the inductive principle, which closes its contacts on sustained overload. A damping magnet applied to the disk makes the speed of rotation proportional to the driving force. The time element is adjusted by varying the distance through which the moving contact on the disk shaft must travel before engaging the stationary contact on the adjusting arm. This scheme of overload protection is particularly adaptable for applications where overloads are frequent, the device not being effective unless the overload is sustained or of large magnitude, depending upon the setting.

The reversing switch group may be seen on the left of the incoming line panel in Fig. 1. This unit consists of five UP27 pneumatic switches of high current capacity and strong design. They are mounted on an angle-iron framework, together with an air accumulator, a reducing valve, an air cylinder, a check valve, and an air-failure relay. This relay is so designed as to open the low-voltage relay circuit, when the air pressure drops to approximately 45 lb. per square inch. The main switches are so adjusted as to

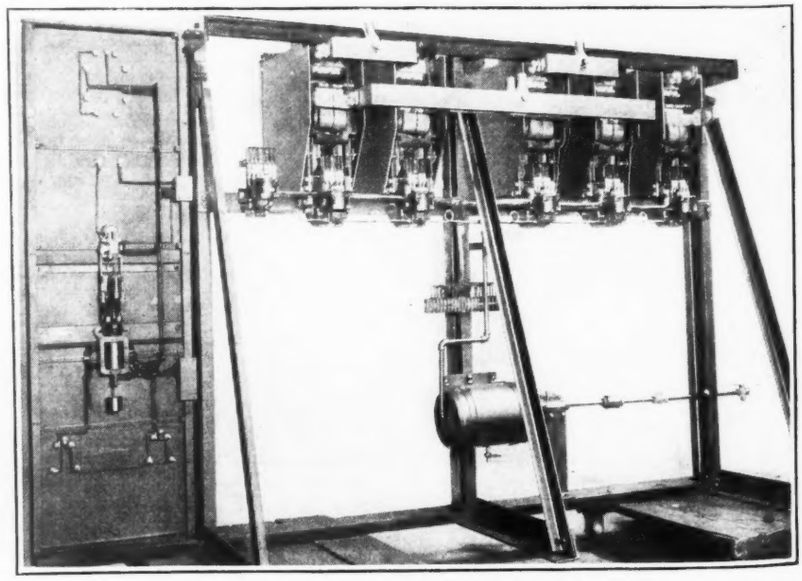


Fig. 2—Rear view of full magnetic type control

open their contacts when the pressure drops to approximately 35 lb.

These switches are suitable for group, cabinet, or frame mounting. The switch consists of two upright insulated members which support the upper contacts, blow-out coils, arc horns, and terminal blocks. The upright members are bolted to an air-cylinder housing, and the lower contact is fastened to a piston by means of an insulated coupling and a piston rod. The arc shields are supported about the main contact and are removable as a unit.

Flexible copper tubing connects the switch magnet air valves. The switch members are unusually strong, and all parts are interchangeable. Each switch is provided with two sets of contacts, main and auxiliary, or arcing contacts. The blowout coil is so arranged between the main and auxiliary contact that when the switch is fully closed, the blowout coil is short-circuited, and the contact travel is such that the auxiliary contacts close before the main contacts, and open after the main contacts, thus relieving the main contacts of the arc-rupturing duty.

Interlocks are made in the form of a molded block supporting the copper contacts, and are shaped to meet the sequence of the particular application. Copper contacts are so placed that the finished interlock presents a smooth surface or face, thus permitting the contact fingers to move over a flat surface. The pneumatic switches are positive in their action, give definite contact pressure, and operate at a very high speed.

In Fig. 1 the air accumulator cylinder is shown. To the left of it is an air-reducing valve, a strainer, and a check valve. These switches are made in several designs. Selection may be made according to their application. They can be used on circuits up to 2,400 volts.

The secondary-control panel front and rear views, respectively, are shown in Figs. 3 and 4. This panel is built up of slate sections. The control for the auxiliary—namely, the motor-generator set and oil pump motor—also forms a part of this panel, and may be seen on the right side of Fig. 3. On the panel for the motor-generator set are mounted a voltmeter, an ammeter, a field rheostat, and a thermal overload relay—controlled by means of a start and stop push button located on the pulpit or operator's panel.

The oil-pump motor used for pumping oil to the reduction gear is protected by a thermal overload relay, and is also controlled by means of a start and stop push button located on the pulpit panel. But it is so connected that if the main motor is started, the oil pump will automatically be started and will continue to operate until the main breaker is opened or the stop button pressed.

The master accelerating drum is driven by a constant-speed, 110-220 volt, 60-cycle motor. This drum operates continuously as long as the motor-generator set is in operation, and the speed of the drum is such that the last six secondary contactors are closed in ten seconds. The connections are so made that each revolution of drum closes the two switches.

There are eight secondary contactors, rated at 3,000 volts and 800 amp. Under each contactor is mounted a multiple-unit type, disk interlock for properly interlocking the contactor in the circuit.

An eight-step special resistor regulates the speed of the 900-hp. motor designed for heavy intermittent regulating duty to give approximately 30 per cent full-load starting current on the first point of the controller and 30 per cent full-load starting torque. These grids are 14-in., 3-point, and 8-frame. A drum back-out switch is used to back out from the hoist or lower position after either of the limit switches have been operated.

The following description, with the aid of the schematic diagram shown in Fig. 5, will explain the operation of the control. First, the main breaker is closed. The oil pump is next started, followed by the starting of the motor-generator set, and the exciter field is adjusted for 125 volts d.c. Starting the motor-generator set also starts the pilot motor, which drives a timing drum, which in turn automatically accelerates the main motor by definite time-limit acceleration. The drum has a feeder ring supplying current to two segments which alternately make contact, closing two switches at each revolution. These contacts are indicated as "DS." If the emergency switch is closed, the closing of the breaker also closes a breaker interlock, which energizes a low-voltage relay, and the control is then ready for operation.

If the master switch is moved to the first position, switches 89 and 49 are closed, which in turn closes the pneumatic switches 6-7 and 5 and also the corresponding interlocks, which starts the main motor with all of the resistance in the secondary. If the master switch is moved successively to the remaining positions, the motor is automatically accelerated to full speed. It is to be noted that the first three steps of speed control are manually controlled. The remaining steps are automatic, provided the master switch is moved to the last position.

A maximum torque, foot-operated button is provided which closes contactor 36, which in turn closes accelerating contactor 14. Contactors 21 and 22 are two special interlocking voltage relays, which open when voltage is applied to the motor and prevent the closing of one set of pneumatic switches while the other set is still closed. In addition,

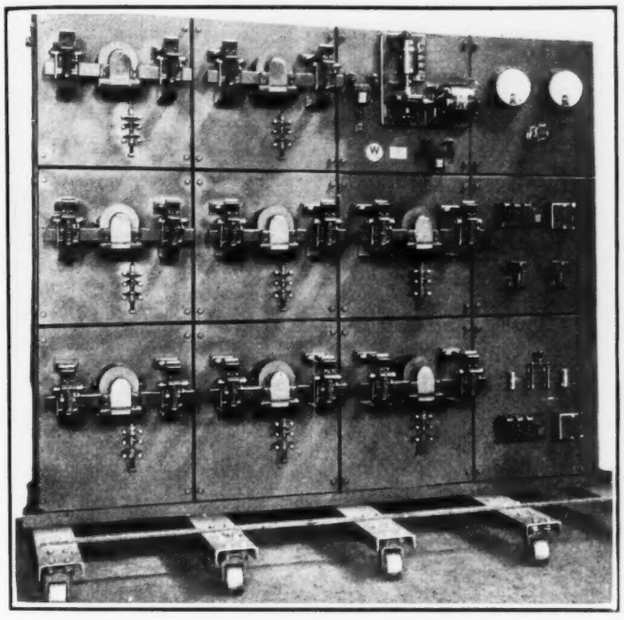


Fig. 3—The secondary control panel, front view

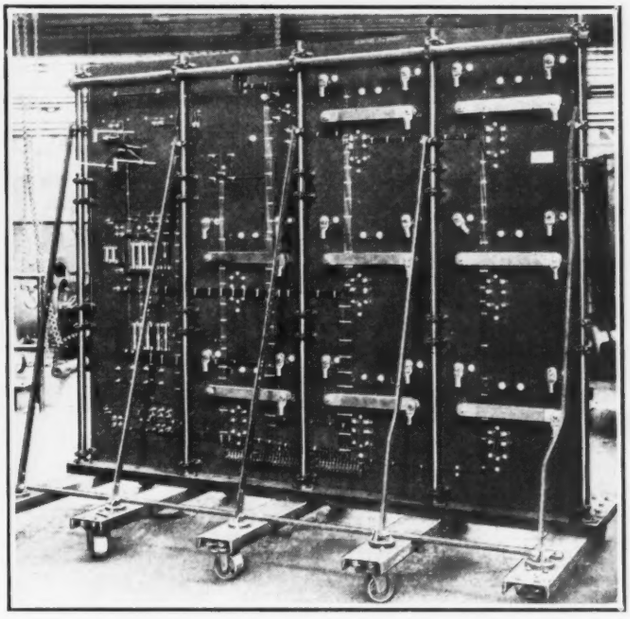


Fig. 4—Secondary control panel, rear view

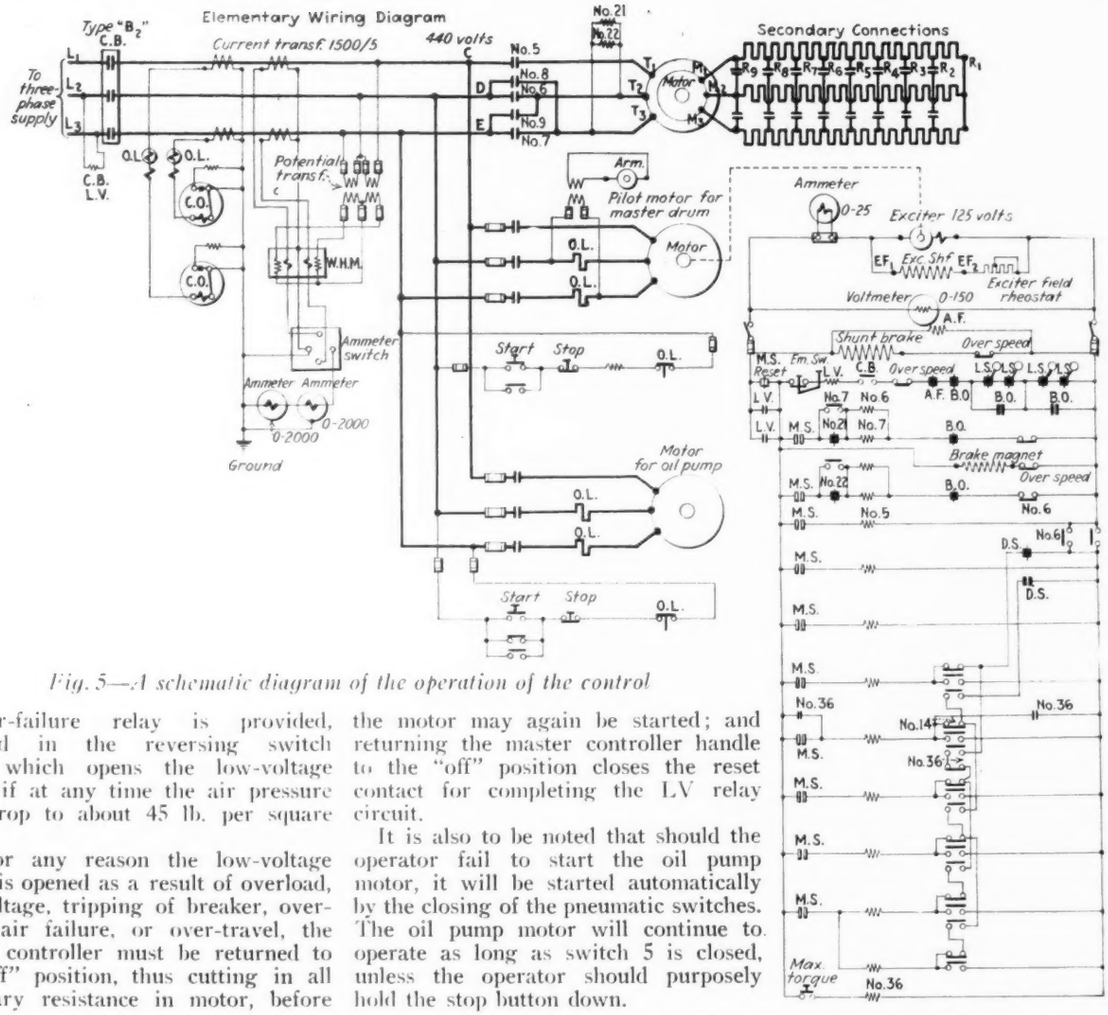


Fig. 5—A schematic diagram of the operation of the control

an air-failure relay is provided, mounted in the reversing switch group which opens the low-voltage circuit if at any time the air pressure shall drop to about 45 lb. per square inch.

If for any reason the low-voltage circuit is opened as a result of overload, low voltage, tripping of breaker, overspeed, air failure, or over-travel, the master controller must be returned to the "off" position, thus cutting in all secondary resistance in motor, before the motor may again be started; and returning the master controller handle to the "off" position closes the reset contact for completing the LV relay circuit.

It is also to be noted that should the operator fail to start the oil pump motor, it will be started automatically by the closing of the pneumatic switches. The oil pump motor will continue to operate as long as switch 5 is closed, unless the operator should purposely hold the stop button down.

CATALOGS

Outstanding among the bulletins and catalogs issued by manufacturers is the new catalog in Russian of the Sullivan Machinery Co., 122 South Michigan Ave., Chicago. Its title, translated, is "Sullivan Products." This is a handsome illustrated book of 144 pages, 6x9 in. in size, and bound in heavy reinforced paper with an embossed cover in green and gold.

More than twenty different subjects are covered, including a history of the Sullivan company. Full space is given to describing the company's line of air compressors and vacuum pumps. A separate chapter is devoted to the Sullivan air-lift system of well pumping for water supply. Another chapter deals with rock drills and hammer drills of the company's manufacture. Drill-sharpening machines and equipment for heat-treating drill steel are also covered. Other equipment described includes portable hoists, diamond core drills, and coal-cutting machines. Copies may be had on applying to the company's Chicago office, or to its office at 30 Church St., or to the Amtorg Trading Corporation in Moscow.

Another interesting publication is the anniversary number of the *DuPont Magazine*. This has been issued to celebrate the 125th anniversary of the founding of the explosives manufacturing business of E. I. du Pont de Nemours & Co. It contains numerous special articles describing the development of the company, step by step, from its small beginning in 1802 up to its present status as one of the world's largest diversified chemical manufacturing industries. Another feature of the number is a two-page historical map in colors. The cover is a work of art, the design coming down the brush of Walter D. Teague, of New York.

Boiler Instruments—The need that a company may have for flow meters, pyrometers, and CO_2 meters in its boiler plant is dramatically told in the latest catalog of the Brown Instrument Co., Philadelphia, Pa. In addition to the electric instruments already mentioned, the company's catalogs cover electric tachometers, recording thermometers, and pressure and draft gages.

Rock Drill — Sullivan Machinery Co., Chicago. Bulletin 81-M. The "T-3" water hammer drill. Pages 16, illustrated.

Compressors — Sullivan Machinery Co., Chicago. Bulletin 83-G. High-pressure angle compound gas and air compressors WJ-3 and WN-31, two-stage. Pages 16.

Grinding Mill—The Ruth Company, Denver, Colo. Bulletin R-M 12. The Ruth rod mill. Pages 20.

Steel Work—Kansas City Structural Steel Co., Kansas City, Kan. "Economy in steel design." Pages 48, illustrated.

Pulverizers—Bethlehem Steel Co., Bethlehem, Pa. Catalog J. Pages 22, illustrated.

Thickener—United Filters Corporation, Hazleton, Pa. Bulletin 140. The Sweetland thickener. Pages 20, illustrated.

Culverts—Armco Culvert and Flume Manufacturers Association, Middletown, Ohio. Bulletin entitled "Basing Confidence in Culvert Strength on Engineering Facts."

Conveying Equipment — Stephens-Adamson Manufacturing Co., Aurora, Ill. Bulletin 158. The September issue of "The Labor Saver." It contains an article on conveying equipment in a copper smelter.

Turbines—Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Turbines for mechanical drive, 5 to 750 b.hp.

Ball Bearings — Split Ballbearing Corporation, Lebanon, N. H. A bulletin entitled "Split Ballbearings or 6 per Cent Bonds. A Study in Investment Returns."